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GIS-Assisted Spatial Data Management
for Corps of Engineers Real Estate Activities

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Lopez

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GIS-Assisted Spatial Data Management for Corps of Engineers Real Estate Activities

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Final report

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Preface

At the time of publication of this report, Director of ERDC was Dr. James R. Houston. Commander and Executive Director was COL John W. Morris III, EN.

This report should be cited as follows:

1 Introduction

Currently the U.S. Army Corps of Engineers (CE) relies primarily on hard-copy paper maps and documents to manage real estate assets. It is now widely understood that real estate data are fundamentally geospatial and that there is great advantage to managing and maintaining cadastral information in a geographic information system (GIS). Such a shift in data management would increase efficiency for storing, retrieving, processing, and editing information by all users and would make cadastral real estate data more readily available throughout the Corps and to the public. Research funded under the Corps Civil Works Research and Development Geospatial Technologies Program was initiated to avoid the development of numerous incompatible real estate GIS solutions within the Corps.

This report summarizes the results of research to develop and demonstrate a GIS-assisted approach to meet the spatial data management and analysis demands of the Corps real estate activities. The research resulted in the following products:

   a. A Cadastre Real Estate GIS database design that is compliant with the CADD/GIS Technology Center Spatial Data Standards (SDS) (Information Technology Laboratory (ITL) 2001).

   b. A Cadastre Real Estate GIS Software Tool[1] that implements the SDS-compliant Cadastre Real Estate GIS database design in the object-oriented ArcInfo 8 software and that populates the database by linking to the non-spatial Real Estate Management Information System (REMIS).

   c. Implementation of a Cadastre Real Estate GIS at a Corps project.

   d. Technology transfer.

A document is also being developed on issues related to data conversion, such as converting hard-copy paper maps and digital real estate data to a GIS format. The document will be posted on the technology transfer Web site when completed.

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[1] A preliminary version of the software tool was initiated in Work Unit 33179, Linking Existing Corporate Information Systems to GIS, but the software tool was completed, tested, and documented in this work unit (Work Unit 33181).

2 A Cadastre Real Estate GIS Database Design

The Cadastre Real Estate GIS database design was developed to be part of an Enterprise GIS implementation. Figure 1 illustrates the components considered in the database design, which addresses the needs of not only the Corps' Real Estate Division, but of all business programs that utilize cadastral real estate data. The activities that are conducted by the business programs, such as Navigation, Flood Control, and Real Estate, determine the geospatial and tabular data included in the database design. The geospatial and tabular data must use a spatial data standard to provide uniformity among offices. The SDS is the Corps of Engineers official spatial data standard.
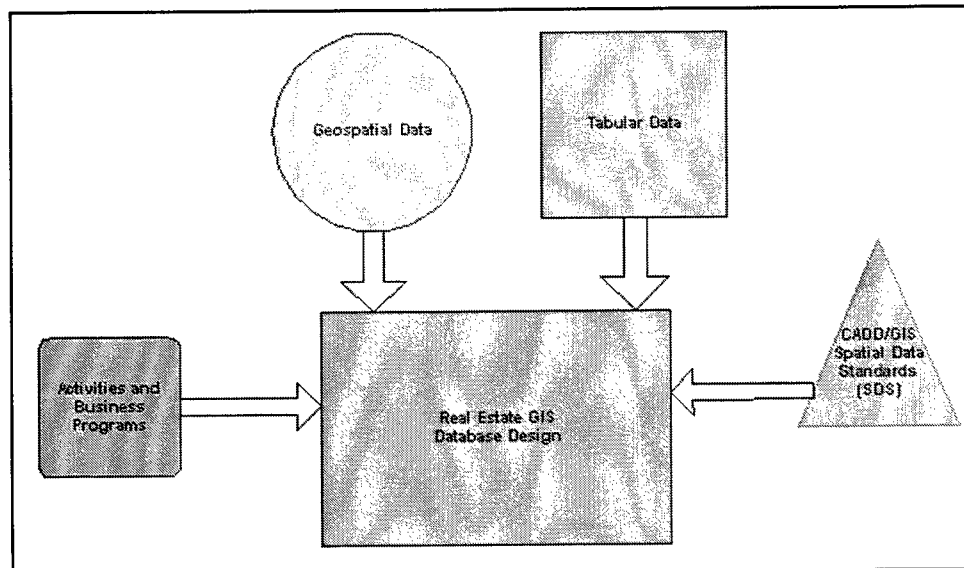
Figure 1. Components considered when developing the Cadastre Real Estate GIS database design

Business Programs

The Real Estate GIS database design was developed by examining the needs of all business practices within the Corps that utilize real estate data. Input from Corps Project, District, Division, and Headquarters offices was solicited through workshops, e-mail distributions, and focus groups. A real estate GIS needs assessment report developed for the Rock Island District was also utilized (Stanley Consultants 1999). The intent was to develop a design that would address the needs of most programs and users by determining the theme and attributes needed to describe the real estate cadastral data.

Real Estate Geospatial and Tabular Data

The database incorporates both geospatial and tabular data (Figure 2). Geospatial features are geographically referenced to a real-world location (the spatial part of the database). Each geospatial feature has an "attached" attribute table containing pertinent data (the tabular or non-spatial part of the database).

Figure 2. Sample view of the database, showing the geospatial and tabular data

The geospatial data must be developed from existing hard-copy maps or from other sources, such as existing CAD (computer-aided design) files. There are
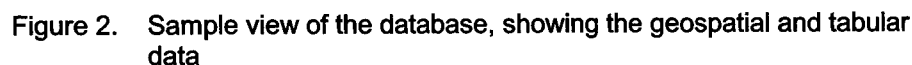
various options available for converting the data to digital GIS files, such as digitizing, scanning and heads-up digitizing, and using coordinate geometry. A white paper being prepared as part of this project will address the advantages and disadvantages of the different techniques.

The majority of the tabular data came from the existing Real Estate Management Information System (REMIS), created by the Corps to manage the Corps real estate holdings. It is a non-spatial database. A robust set of attributes to address the needs of most of the users was selected from various tables in the REMIS database and incorporated into the database design. This does not replace the REMIS database but allows the efficient use of the existing non-spatial REMIS database in a geospatial environment.

CADD/GIS Technology Center Spatial Data Standards

The SDS, which provides a standard for GIS implementation at Army Corps of Engineers Civil Works activities; U.S. Air Force, Army, and Navy installations; and state and local governments, was used in the development of the Cadastre Real Estate GIS database. The SDS provides standard table formats, such as data types for the fields, lengths of field values, and domains, for the themes proposed for the GIS. This provides uniformity between Corps offices, so that similar information is available in the same format.

Prior to this study, the SDS did not contain tables to fully address cadastral real estate needs, so the necessary real estate spatial data tables were developed. Initially, draft versions were developed based on input from a broad range of Corps personnel, workshops, existing studies within and outside the Corps, and real estate documents. A draft database design was presented at a workshop at the Fort Worth District. Workshop participants, including individuals from diverse professional areas and levels within the Corps, provided a review and revision of the design. A revised version was distributed for review throughout the Corps, as well as to other agencies involved in cadastral and database standards development. The draft design was updated and incorporated into the SDS version 2.0.

Five new tables were developed and added to the SDS version 2.0. The themes for the five tables are listed below.

a. *Acquisition Tracts*, which includes all tract boundaries for all land acquired by fee or less-than-fee transactions. Fee acquisitions are lands that the Corps has purchased, while less-than-fee acquisitions are lands that the Corps has purchased the right to use via, for example, easements, leases, or permits.

b. *Outgrants,* which includes the outside boundary or point location of all land outgrants. An outgrant is Corps-owned land that is leased to another party; examples of outgrants include easement, licenses, and permits.

c. *Disposals,* which includes the outside boundary of all disposed land. Disposed land includes land that the Corps sells or transfers to another party.

d. *Encroachments,* which includes the outside boundary or point location of all encroachments. An encroachment involves the unintentional use of Corps land by another party.

e. *Fee Boundaries,* which includes the outside boundary of all land acquired by fee.

The SDS Data Model presents information by entity set, entity class, entity type, attribute tables, and domain tables (Information Technology Laboratory 2001). For the Cadastre Real Estate GIS database design, the entity set name is "cadastre" and the entity class name is "real estate." The entity type name, attribute table name, and domain table names depend on the entity set and entity class.

Appendix A gives the new SDS tables for the five Cadastre Real Estate GIS database themes. Each table contains fields for the name, type, and length of the attribute; the name of any domain tables used for the attribute; the name of the REMIS table where the attribute is located; the name of the attribute as it appears in the REMIS table; and the definition of the attribute.

3 A Cadastre Real Estate GIS Software Tool

A software tool was written to automate the generation of a Cadastre Real Estate GIS. This tool utilizes the ArcGIS 8.1 software (ESRI 2001) and creates a personal geodatabase. Detailed instructions for this tool are found in Appendix B. The tool performs the following tasks:

a. Generates a personal Cadastre Real Estate geodatabase.

b. Generates SDS-compliant Cadastre Real Estate tables, relationships between tables, and domain values within the geodatabase.

c. Adds the geographic features (e.g. tracts, outgrant boundaries, disposal boundaries, encroachment boundaries, and fee boundaries) from existing ArcInfo shapefiles or coverages to the geodatabase.

d. Links the geodatabase to the REMIS Oracle database to retrieve the appropriate records to populate the SDS-compliant Cadastre Real Estate tables in the personal geodatabase. This tool provides a one-way link to REMIS; it does not make changes, updates, or deletions to the REMIS database. REMIS users will continue to enter and modify data using the existing REMIS interface.

e. Allows the user to manually input attribute data into the tables (e.g. for attributes that are not in the REMIS database or are not populated in the REMIS database).

f. Populates the area and perimeter attributes based on the geospatial data.

g. Deletes records in the personal geodatabase tables that no longer exist in the REMIS Oracle database.

4   Implementation of a Cadastre Real Estate GIS at a Corps Lake

The Fort Worth District, Corps of Engineers, has been a partner in the Cadastre Real Estate GIS project. Lake of the Pines, Texas, served as a prototype site at which the SDS-compliant Cadastre Real Estate GIS database design was implemented using the software tool.

Data Conversion

Prior to their involvement in this research, the Fort Worth District had converted their hard-copy segment maps for Lake of the Pines to a digital format. This was done by first scanning the segment maps, generating a raster image. A global positioning system (GPS) was used to locate survey monuments along the project boundary so that the monuments could be used to georeference the scanned segment maps. The georeferenced maps were then displayed on a computer screen, and heads-up digitizing was used to develop a vector coverage of the tract boundaries. Each tract was assigned a project identification and tract number. An ArcView shapefile was then developed from the coverage and used in conjunction with the Cadastre Real Estate GIS software tool to generate a fully functional personal geodatabase for Lake of the Pines.

Data conversion has been completed for fee and less-than-fee tracts, outgrants, and fee boundaries. It has not been completed for encroachments or disposals, so feature datasets for these two themes are not complete.

Geodatabase Development

The software tool was used to create a Cadastre Real Estate geodatabase for Lake of the Pines. The geodatabase structure is illustrated in Figure 3, with the geodatabase encompassing the entire Fort Worth District. The feature dataset includes all cadastre data within the district, while the feature classes represent
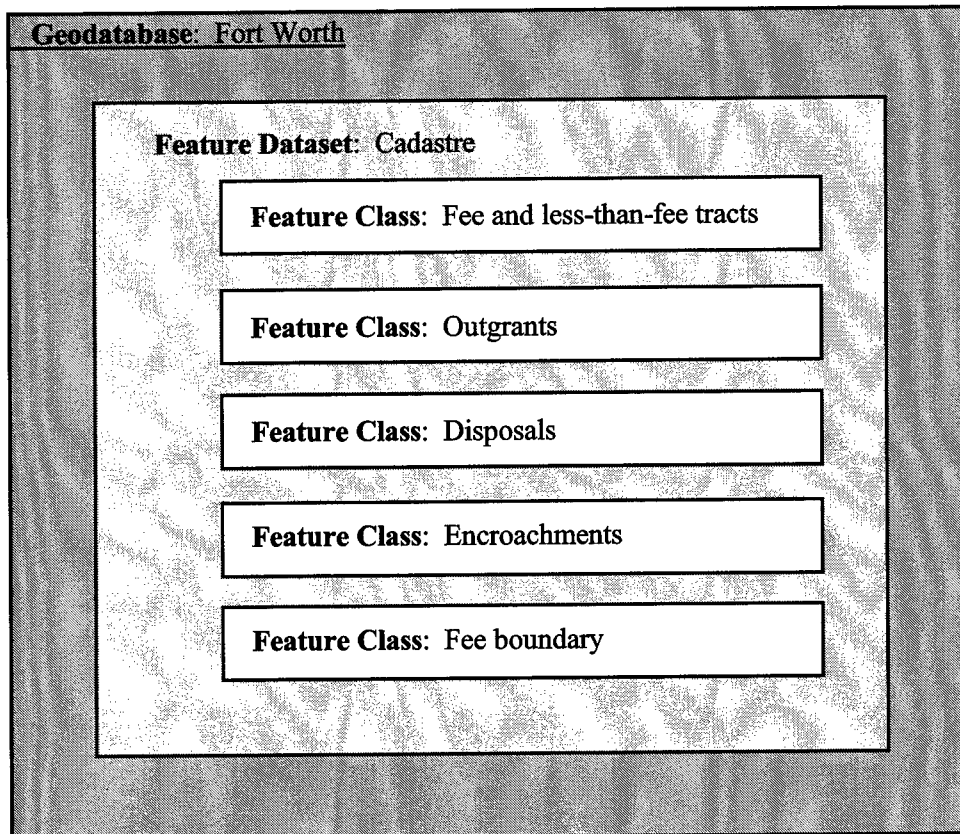
Figure 3.   Personal geodatabase structure for cadastral real estate data

themes of cadastre real estate data, such as fee and less-than-fee tracts, outgrants, disposals, encroachments, and fee boundaries.

The software tool allowed the geospatial data from the ArcView shapefiles to be incorporated into the fee and less-than-fee tract, outgrant, and fee boundary feature classes. It also made a link to the REMIS database to populate the attributes in the three feature classes.

The Lake of the Pines
Acqisition Fee and Less-than-Fee Tracts

Real Estate Acquisition
- [ ] Fee Aquisition
- [▓] Less-than-Fee Aquisition
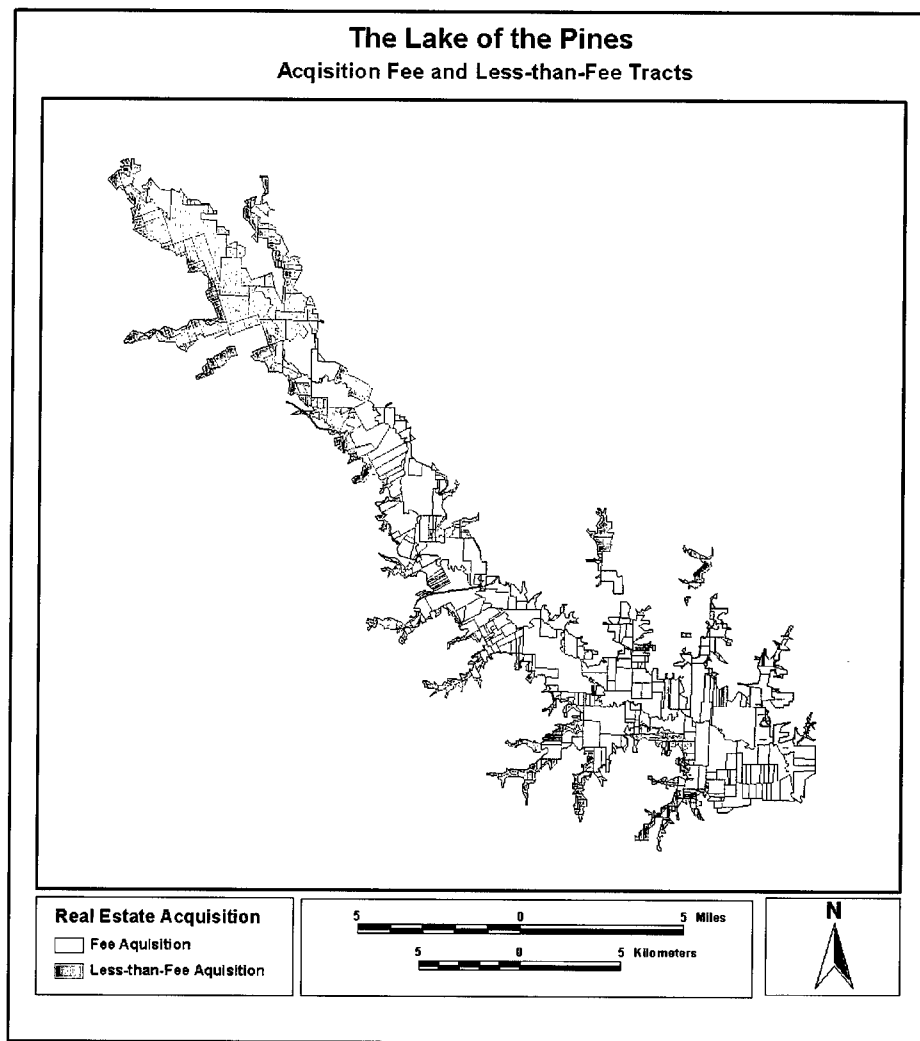
Figure 4.   Tracts acquired by fee and less-than-fee for Lake of the Pines, TX

Figure 4 shows the fee and less-than-fee tracts for Lake of the Pines. The ability to query and display tracts based on the type of acquisition allows more efficient and effective management opportunities. For example, if a change in water management is being studied for a lake, the GIS can be used to determine how the affected tracts were acquired. If they were acquired by less-than-fee, the type of easement can be determined.

The Lake of the Pines
Acqisition Fee and Less-than-Fee Tracts
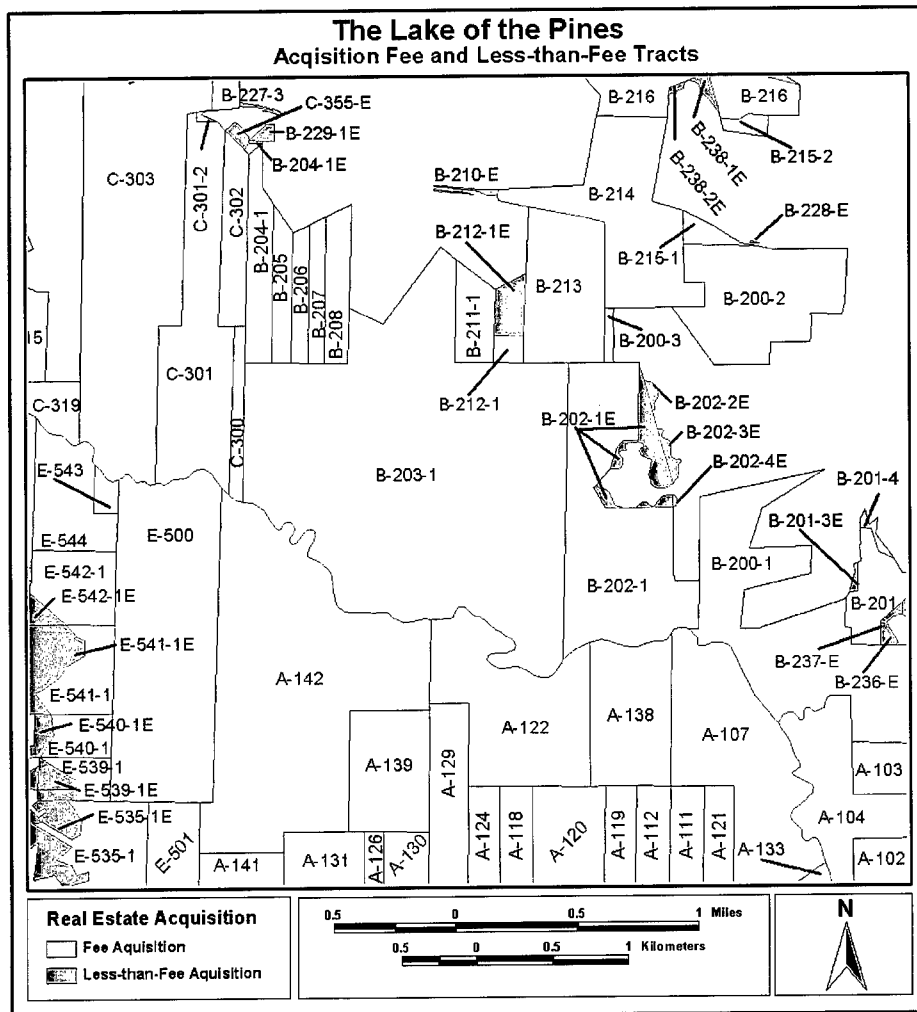
Figure 5. Blowup of one area of Lake of the Pines showing tracts labeled with the tract number and color coded depending on whether acquired by fee or less-than-fee

Areas of interest can be displayed in greater detail and labeled or color coded based on attribute values. For example, Figure 5 shows a blowup of one area of Lake of the Pines, with the tracts labeled by tract number and displayed in color according to whether they were purchased by fee or less-than-fee.

The Lake of the Pines
Acquisition Fee and Less-than-Fee Tracts with DOQ Data.
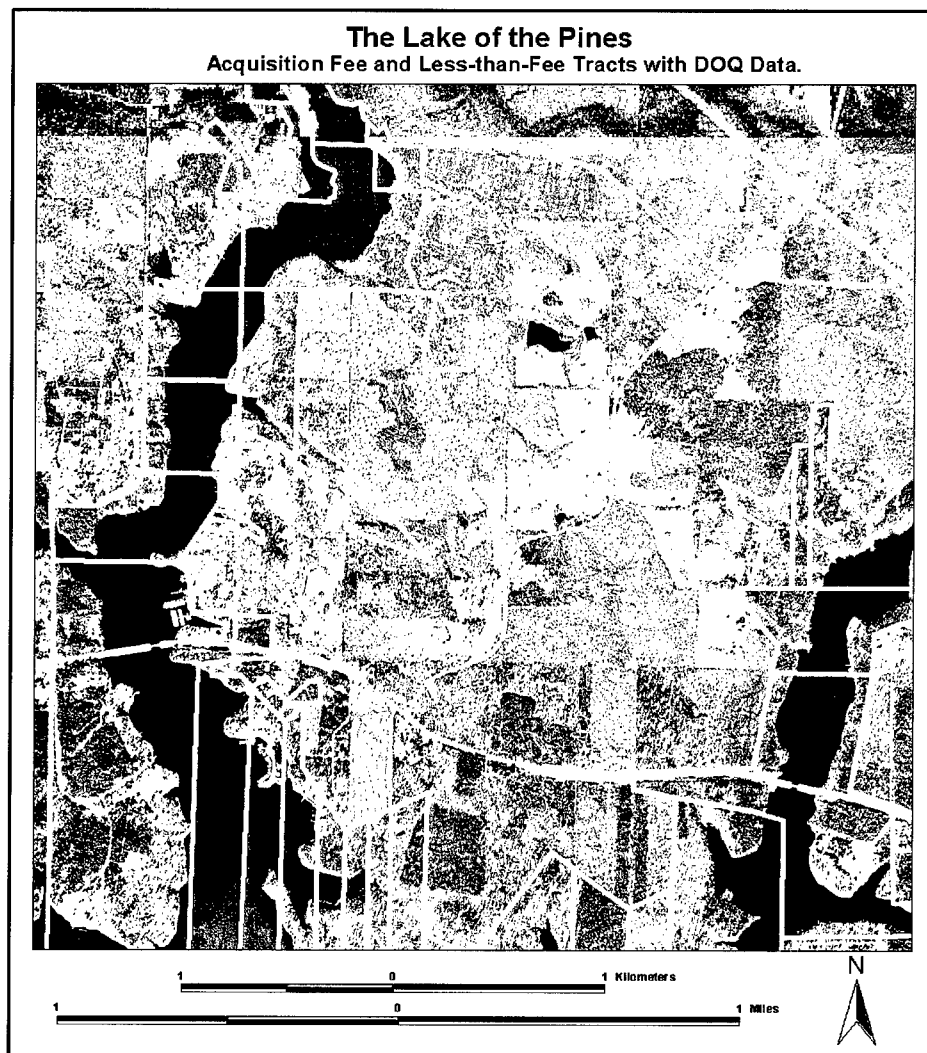
Figure 6.   Project boundary tracts (shown with a solid line), with DOQ data
displayed in background

By utilizing the tract maps with other data, such as digital orthographic
quadrangles (DOQs), tasks such as locating tracts becomes significantly easier.
For example, in Figure 6, the boundary tracts for Lake of the Pines are shown
with a solid line and can be used with the DOQs to aid in maintaining project
boundaries and checking for encroachments.

The Lake of the Pines

Real Estate Outgrants

Pipeline Outgrant Attribute Table

Contract_No	DACW63-2-85-0507
Purpose_d	RIGHT_OF_WAY
Project_id	LP
Type_d	EASEMENT
Row_Type_d	TT
Status	A.
Effect_Date	19841012
Expir_Date	20341011
Schin_Date	19970812
Actin_Date	0
Lstin_Date	19970812
Comp_Ind_d	Y
Inspector	
Grantee_No	A4PMO3
Grnte_Name	ETEX TELEPHONE
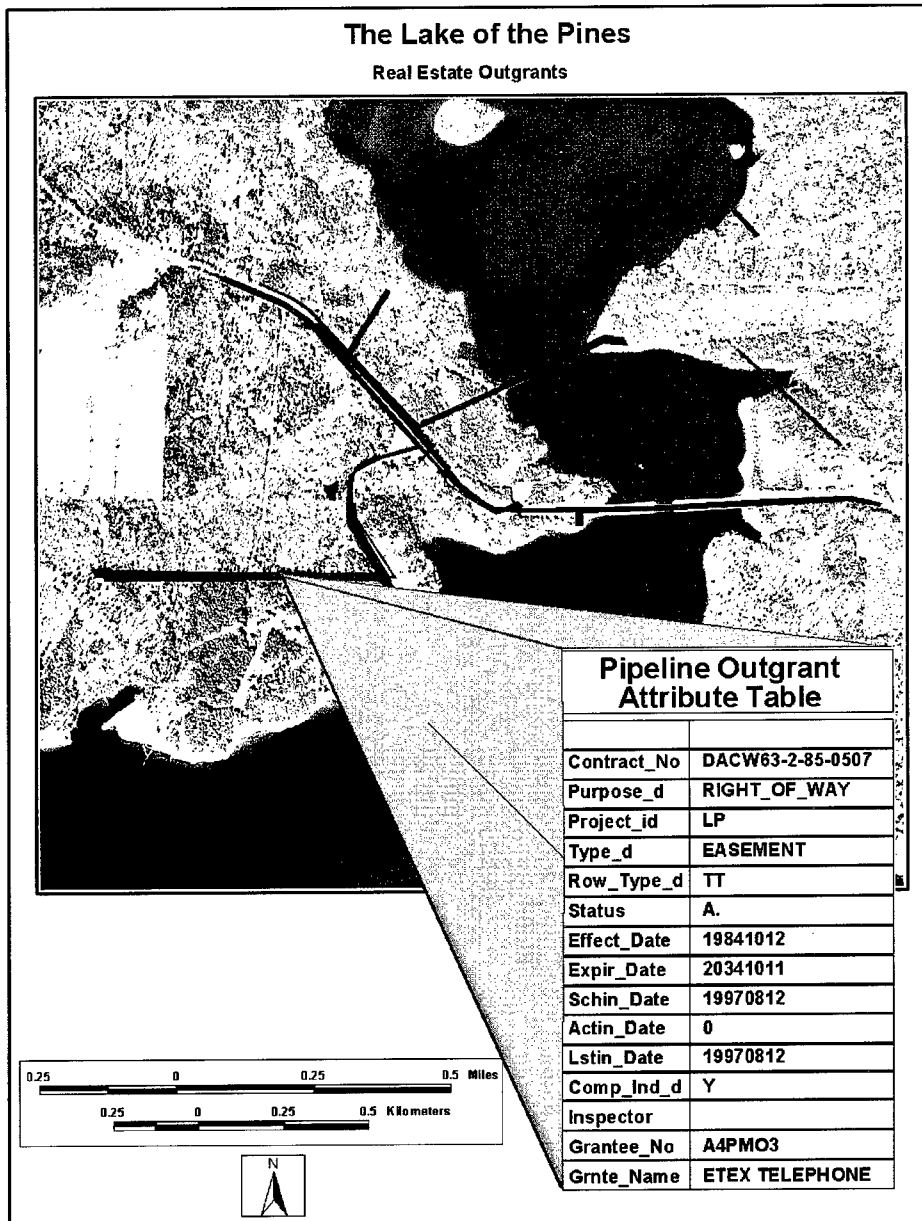
Figure 7.   A portion of the outgrants for Lake of the Pines, TX

Figure 7 shows a portion of the outgrants for Lake of the Pines. Information about each outgrant can be displayed on the screen, showing tabular data such as the type of outgrant (easement, permit, etc.), status (active, inactive, terminated), effective and expiration dates, and grantee name.

The Lake of the Pines
Proposed Real Estate Outgrant

Real Estate Outgrants

Proposed Pipeline

Current Pipelines

Wetlands

025   0   025   0.5 Miles

025   0   025 Kilometers
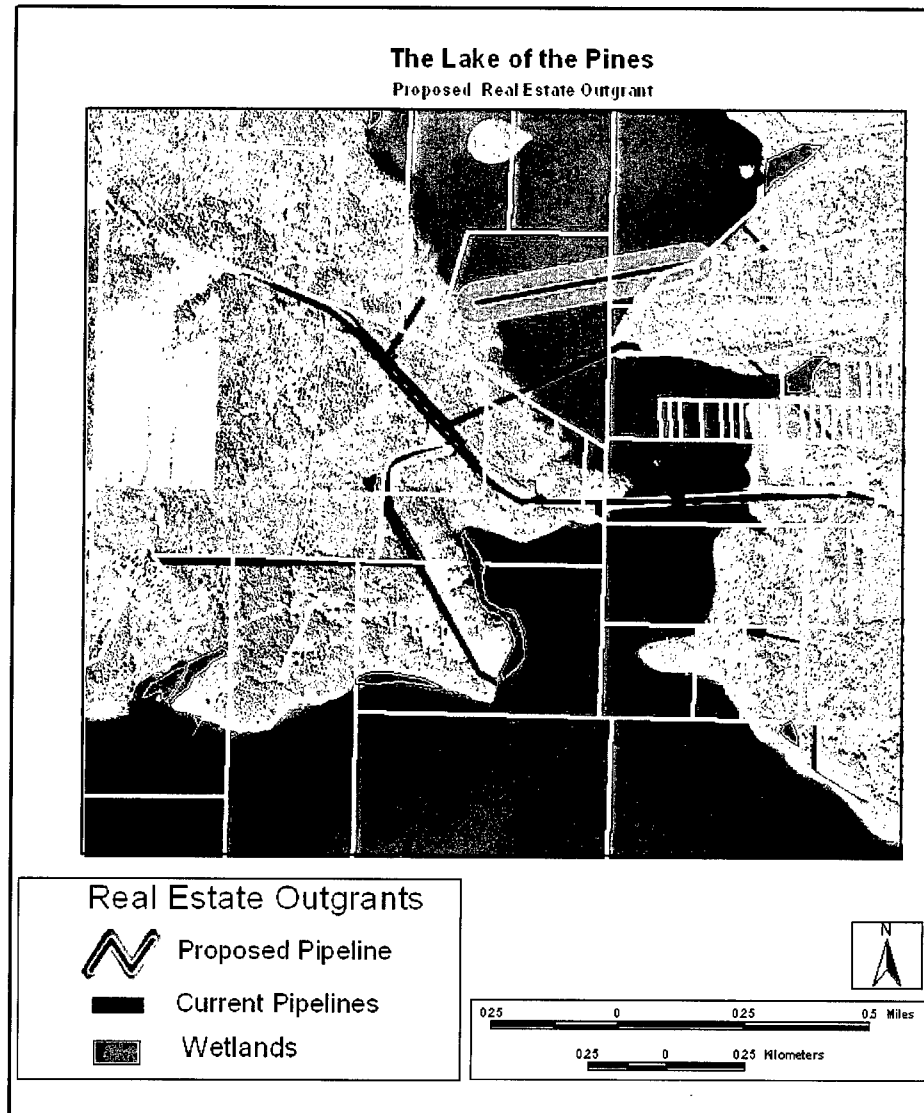
Figure 8.   Proposed outgrant displayed with existing outgrant and DOQ data

The business practice of issuing an outgrant can be streamlined by having the ability to display a proposed outgrant with existing outgrants, as well as other types of infrastructure and environmental data. For example, if the project receives a request for an outgrant for a gas pipeline, the proposed pipeline can be input into the GIS. Buffers can be drawn around the proposed pipeline to determine if the pipeline construction area will impact the surrounding area or if the proposed pipeline conflicts with existing outgrants. Figure 8 shows a proposed pipeline with a 200-foot buffer. This allows the project manager to address problems with the request at an early stage when changes in location can be made before time and resources are expended. The existing outgrants can also be queried to determine if the requester already has active, inactive, or terminated outgrants. If the requestor already has outgrants, queries such as the compliance

5 Technology Transfer

This report, the software tool, and the instructions to install and utilize the tool have been placed on a Web site, which can be accessed at *http://www.wes.army.mil/el/gdaf.* On the Geospatial Data Analysis Facility home page, click "PRODUCTS." On the Products page, click on the Real Estate icon.

References

Environmental Systems Research Institute, Inc. (2001). "Arc/Info (computer program)," Redlands, CA.

Information Technology Laboratory. (2001). "CADD/GIS Technology Center Spatial Data Standard, Version 2.0." U.S. Army Engineer Research and Development Center, Vicksburg, MS.

Stanley Consultants. (1999). "Real estate geographic information system needs assessment," U.S. Army Engineer District, Rock Island, Rock Island, IL.

Appendix A
New Tables Added to SDS
Version 2.0

Table A1. (Concluded)

ATTRIBUTE	TYPE	LENGTH	DOMAIN	REMIS TABLE	REMIS ATTRIBUTE	DEFINITION
Legal_area	D			rp_county_area	concatenation of county_rural_acres, county_urban_acres, rural_adjust_acres, and urban_adjust_acres	Size of area as computed from legal data. Changed from decimal to single type to be compatible with the type in ArcCatalog.
Lgarea_u_d	C	16	d_uom			The unit of measure for area.
Perim	D					The distance around the boundary of the area, zone, or subject item in linear units.
Perim_u_d	C	16	d_uom			The unit of measure for length
grid_value	R					A numeric identification of a raster element in an image or grid that represents the feature.
Instln_id	C	20				Foreign Key. Used to link the record to the applicable INSTALLATION record from the RP_PROJECT table in REMIS.
facil_id	C	20				Foreign Key. Used to link the record to the Facility Record.
User_flag	C	20				An operator-defined work area. This attribute can be used by the operator for user-defined system processes. It does not affect the subject item's data integrity and should not be used to store the subject item's data.

Table A2. (Concluded)

ATTRIBUTE	TYPE	LENGTH	DOMAIN	REMIS TABLE	REMIS ATTRIBUTE	DEFINITION
Narrative	C	240				General narrative
Legal_area	D			outgrant	total_land_acres	Size of area as computed from legal data. Changed from decimal to single type to be compatible with the type in ArcCatalog.
Lgarea_u_d	C	16	d_uom			The unit of measure for area.
Coord_id	C	20				Foreign Key. Used to link the record to the appropriate point coordinate record(s).
Coord_x	D					The x component of individual coordinate point.
Facil_id	C	20				Foreign Key. Used to link the record to the Facility Record.
Grid_value	R					A numeric identification of a raster element in an image or grid that represents the feature.
Instln_id	C	20				Foreign Key. Used to link the record to the applicable INSTALLATION record from the RP_PROJECT table in REMIS.
Area_size	D					The size of the area, zone, or polygon in square units.
Area_u_d	C	16	d_uom			The unit of measure for area.
Coord_y	D					The y component of individual coordinate point.
Coord_z	D					The z component of individual coordinate point.
Perim	D					The distance around the boundary of the area, zone, or subject item in linear units.
Perim_u_d	C	16	d_uom			The unit of measure for length
User_flag	C	20				An operator-defined work area. This attribute can be used by the operator for user-defined system processes. It does not affect the subject item's data integrity and should not be used to store the subject item's data.

Table A4. Encroachments

ENTITY SET NAME
cadastre

ENTITY CLASS NAME
cadastre_real_estate

TABLE NAME	TABLE LONG NAME	TABLE TYPE	VERSION	STD
cdrelenc	Encroachment Site	Graphic	2.0	SDS

TABLE DEFINITION This table contains information about encroachments.

ATTRIBUTE	TYPE	LENGTH	DOMAIN	REMIS TABLE	REMIS ATTRIBUTE	DEFINITION
Datalink	I					Graphic Key. A system-generated integer that is used to link the record to graphic entities. Do not populate this field.
Enchr_id	C	30		Encroachment_item	concatenation of proj_id, wi_code, and enc_itm_number	Primary Key. A unique, user-defined identifier for each record or instance of an entity.
Map_id	I					Foreign Key. Used to link the record to the appropriate map.
meta_id	C	20				Foreign Key. Used to link the record to the applicable feature-level metadata record(s).
Media_id	C	20				Foreign Key. Used to link the record to associated multimedia records that reference data such as imagery, video, audio, scanned documents,drawings, and other digital media.
Coord_id	C	20				Foreign Key. Used to link the record to the appropriate point coordinate record(s).
Coord_x	D					The x component of individual coordinate point.
Coord_y	D					The y component of individual coordinate point.
Coord_z	D					The z component of individual coordinate point.
project_id	C	20		Encroachment_item	proj_id	Foreign Key. Used to link the record to the applicable PROJECT record from the RP_PROJECT table in REMIS.
wi_code	C	6		Encroachment_item	wi_code	Work Item Code
Enc_itm_no	R			Encroachment_item	enc_itm_number	Work Item Number
encroachno	C	9		Encroachment_item	encroacher_id	Unique identified for enchroachment
rpt_by_cat	C	16		Encroachment_item	reported_by_category	Who reported the encroachment (e.g. park ranger, neighbor, etc.)
Type_cat_d	C	16	d_tycat	Encroachment_item	type_category	Kind of encroachment
Revr_ind_d	C	16	d_boolen	Encroachment_item	reverse_ind	No means they are encroaching on COE land; Yes means COE encroaching on someone's land
finalres_d	C	16	d_finres	Encroachment_item	final_res_category	How resolution was resolved
Reptd_date	I			Encroachment_item	reported_date	Date encroachment was reported. Format for date is YYYYMMDD (i.e., September 15, 1994 = 19940915).
Res_date	I			Encroachment_item	res_date	Resolution Date. Format for date is YYYYMMDD (i.e., September 15, 1994 = 19940915).
Remarks	C	240		Encroachment_item	remarks	General comments
Narrative	C	240				General narrative
legal_area	D					Size of area as computed from legal data. Changed from decimal to single type to be compatible with the type in ArcCatalog.

(Continued)

Table A4. (Concluded)

ATTRIBUTE	TYPE	LENGTH	DOMAIN	REMIS TABLE	REMIS ATTRIBUTE	DEFINITION
lgarea_u_d	C	16	d_uom			The unit of measure for area.
address_id	C	50				FOREIGN KEY - Links the record to CMGENADD through primary key ADDRESS_ID.
Poc_id	C	50				FOREIGN KEY - Links the record to CMGENPOC through primary key POC_ID.
Area_size	D					The size of the area, zone, or polygon in square units.
Area_u_d	C	16	d_uom			The unit of measure for area.
Perim	D					The distance around the boundary of the area, zone, or subject item in linear units.
Perim_u_d	C	16	d_uom			The unit of measure for length
Instln_id	C	20				Foreign Key. Used to link the record to the applicable INSTALLATION record.
facil_id	C	20				Foreign Key. Used to link the record to the Facility Record.
User_flag	C	20				An operator-defined work area. This attribute can be used by the operator for user-defined system processes. It does not affect the subject item's data integrity and should not be used to store the subject item's data.
Grid_value	R					A numeric identification of a raster element in an image or grid that represents the feature.

A8

Table A5. Fee Boundaries

ENTITY SET NAME
cadastre

ENTITY CLASS NAME
cadastre_real_estate

TABLE NAME	**TABLE LONG NAME**	**TABLE TYPE**	**VERSION**	**STD**
cdrelbnd	Fee Aquisition Boundary	Graphic	2.0	SDS

TABLE DEFINITION This table contains information about parcel/fee acquisition boundaries.

ATTRIBUTE	TYPE	LENGTH	DOMAIN	REMIS TABLE	REMIS ATTRIBUTE	DEFINITION
Datalink	I					Graphic Key. A system-generated integer that is used to link the record to graphic entities. Do not populate this field.
Bndacq_id	C	20		rp_project	proj_id	Primary Key. A unique, user-defined identifier for each record or instance of an entity.
Map_id	I					Foreign Key. Used to link the record to the appropriate map.
Meta_id	C	20				Foreign Key. Used to link the record to the applicable feature-level metadata record(s).
Media_id	C	20				Foreign Key. Used to link the record to associated multimedia records that reference data such as imagery, video, audio, scanned documents,drawings, and other digital media.
Coord_id	C	20				Foreign Key. Used to link the record to the appropriate point coordinate record(s).
Project_id	C	20		rp_project	proj_id	Foreign Key. Used to link the record to the applicable PROJECT record from the RP_PROJECT table in REMIS.
Remarks	C	240		rp_project	remarks	General comments
Narrative	C	240				General narrative
Area_size	D					Size of area as computed from GIS.
Area_u_d	C	16	d_uom			The unit of measure for area.
Perim	D					The distance around the boundary of the area, zone, or subject item in linear units.
Perim_u_d	C	16	d_uom			The unit of measure for length
Grid_value	R					A numeric identification of a raster element in an image or grid that represents the feature.
Instln_id	C	20				Foreign Key. Used to link the record to the applicable INSTALLATION record from the RP_PROJECT table in REMIS.
Facil_id	C	20				Foreign Key. Used to link the record to the Facility Record.
User_flag	C	20				An operator-defined work area. This attribute can be used by the operator for user-defined system processes. It does not affect the subject item's data integrity and should not be used to store the subject item's data.

Appendix B
Instructions for Using the Cadastre Real Estate GIS Software Tool

Software Requirements

a. ESRI ArcGIS 8.x desktop software (either ArcView 8.x, ArcEditor 8.x, or Arc/Info 8.x).

b. Microsoft ODBC for Oracle driver Version 2.573 (to connect to the REMIS database).

c. Oracle 8.x Client software (to set up the ODBC connection to the Oracle database).

d. Microsoft Windows NT Version 4 (SP4 or SP5) or Windows 2000. (ArcInfo 8.0.1 does not support Windows 2000 and Windows NT 4 SP 6. ArcInfo 8.0.2 and up supports both.)

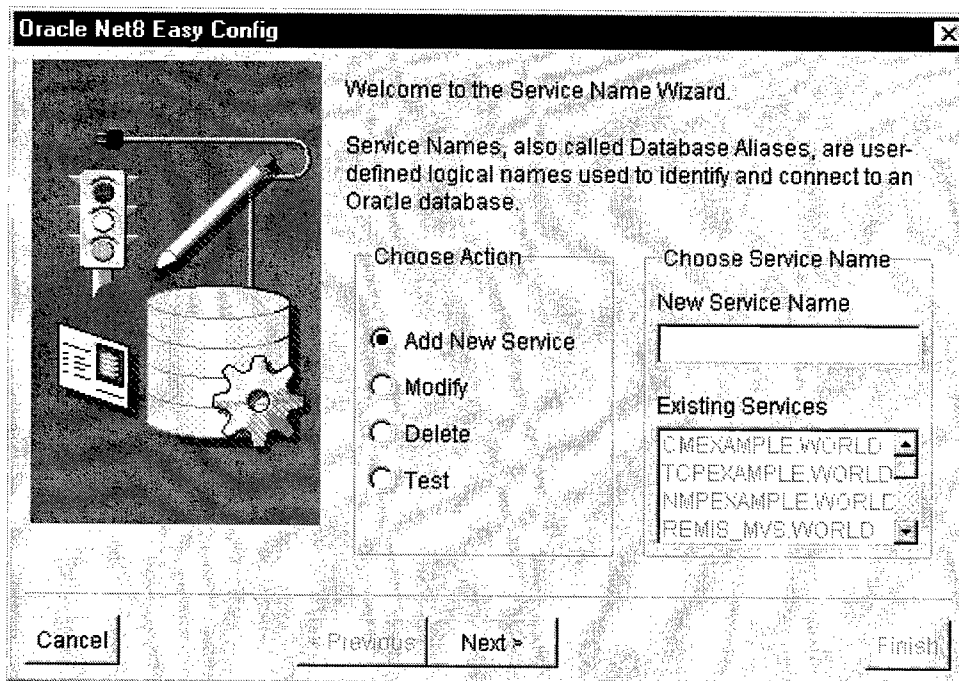e. License Manager and keycodes from ESRI (if concurrent users will be using the ESRI ArcInfo 8 software).

Hardware Requirements

a. System with a fast Pentium chip (e.g. 400+ Mhz).

b. A minimum of 128 MB RAM.

c. Fast disks (SCSI preferred).

d. True color monitor with a minimum of a 16-MB video card.
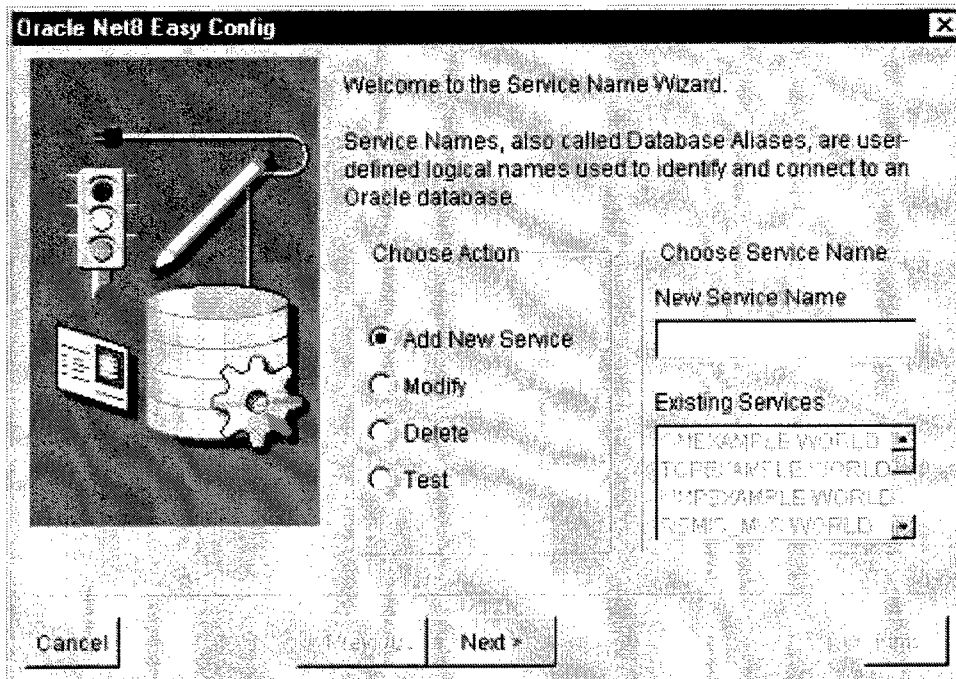
e. Paging File (Swap space) set at a minimum of 300 MB.

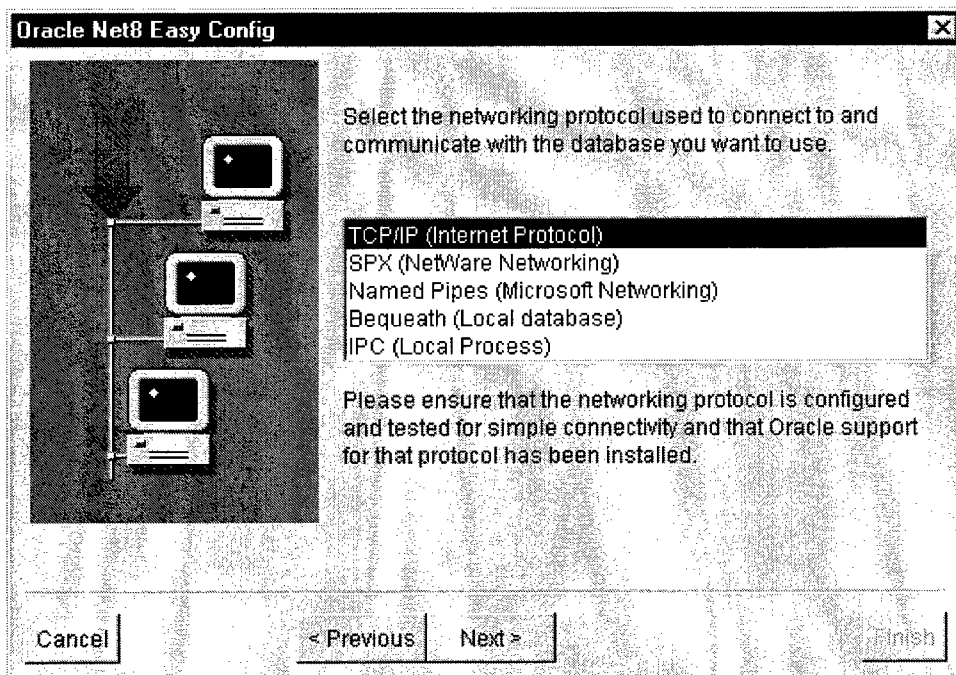# STEP 1: Set up Oracle Services for ODBC connection

1. You must have Oracle Desktop installed on your system.

2. Use Oracle Net 8 Assistant (or Net8 Easy Config) on your local machine to set up the Service Name. In the example below, Net8 Easy Config (Oracle version 8.0.5) is being used. Note, the appearance of the screens or options presented may vary in later versions of Oracle. Enter Net8 Easy Config:

Select *Add New Service*.
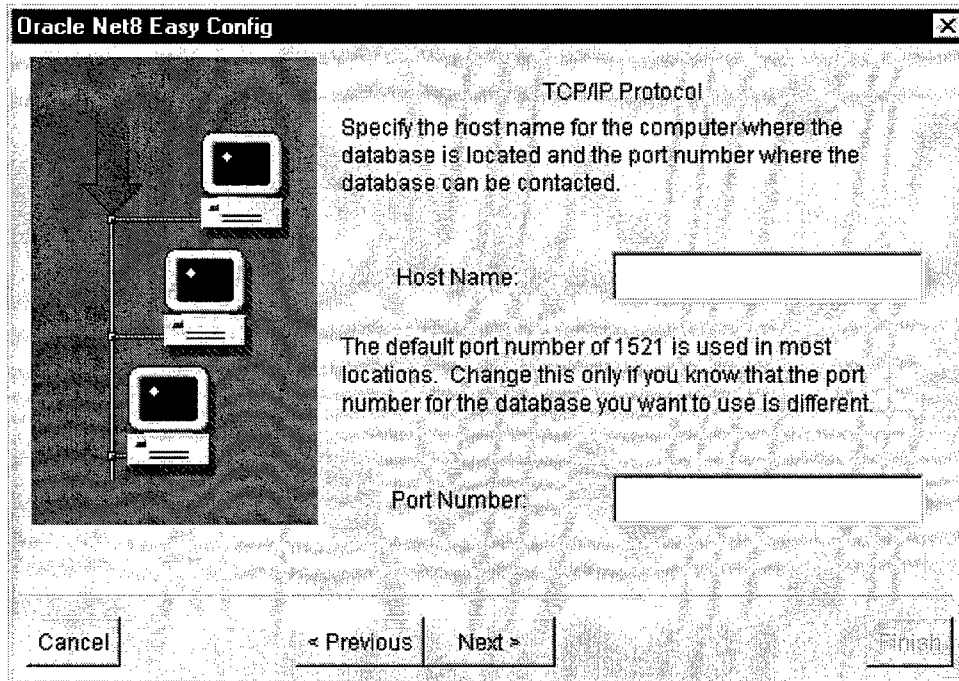Choose a name for your service.

Oracle Net8 Easy Config

Welcome to the Service Name Wizard.

Service Names, also called Database Aliases, are user-defined logical names used to identify and connect to an Oracle database.

Choose Action

- Add New Service
- Modify
- Delete
- Test

Choose Service Name

New Service Name

Existing Services

Cancel   Next >

Click the *Next* button.
Make sure *TCP/IP (Internet Protocol)* is selected.

Oracle Net8 Easy Config

Select the networking protocol used to connect to and communicate with the database you want to use.

TCP/IP (Internet Protocol)
SPX (NetWare Networking)
Named Pipes (Microsoft Networking)
Bequeath (Local database)
IPC (Local Process)

Please ensure that the networking protocol is configured and tested for simple connectivity and that Oracle support for that protocol has been installed.
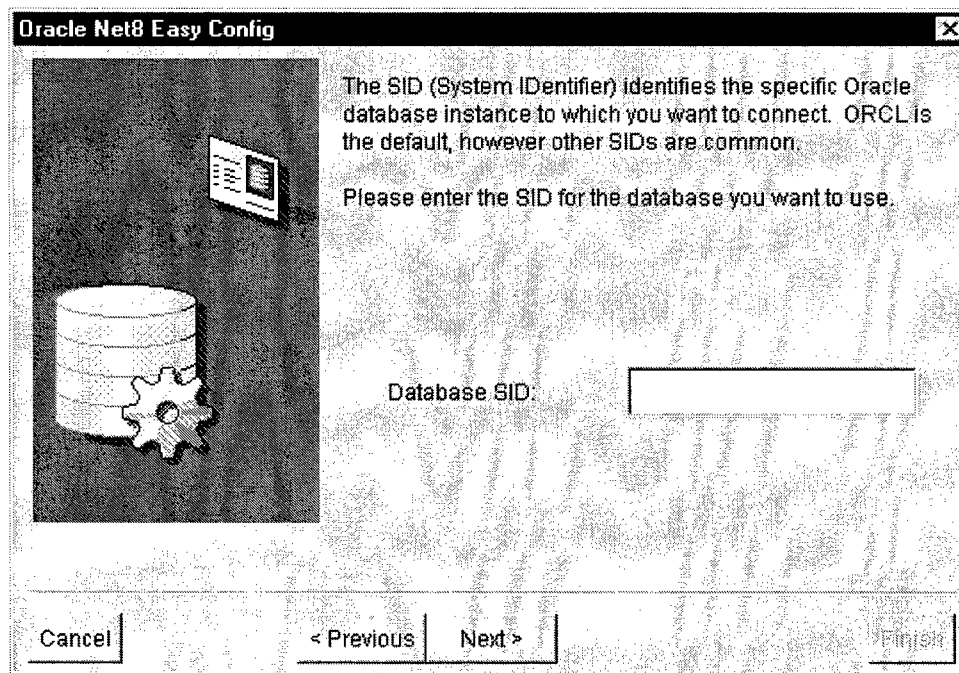
Cancel   < Previous   Next >   Finish

Click *Next.*

Enter the IP address of the server to which you wish to connect. Leave the Port
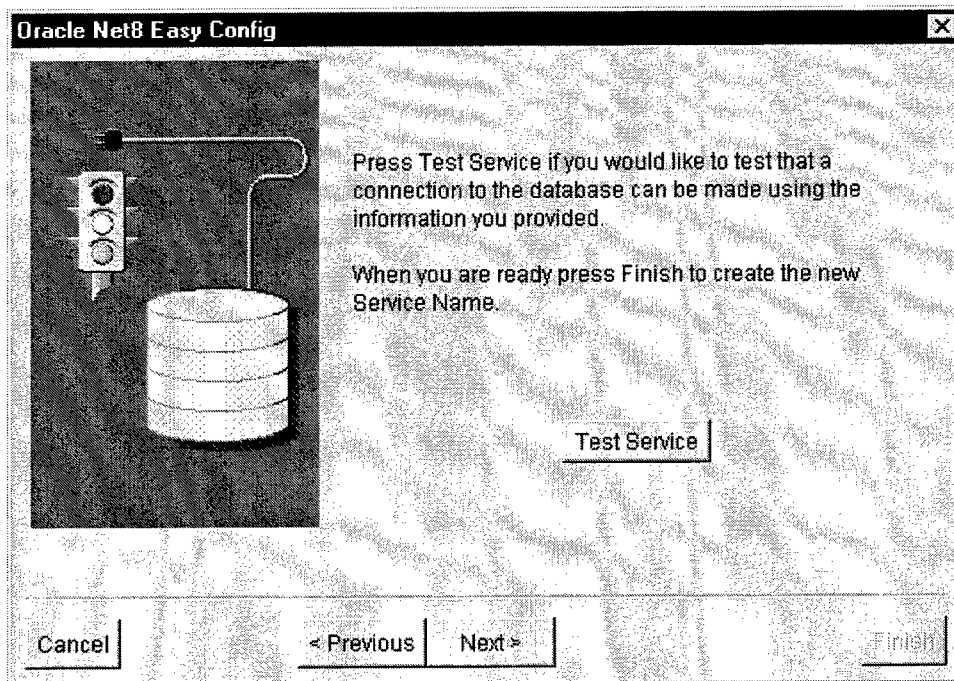number at the default value of 1521.

Click the *Next* button.
Enter the Database SID that is being used on the Oracle server you wish to
connect to.

Click the *Next* button.

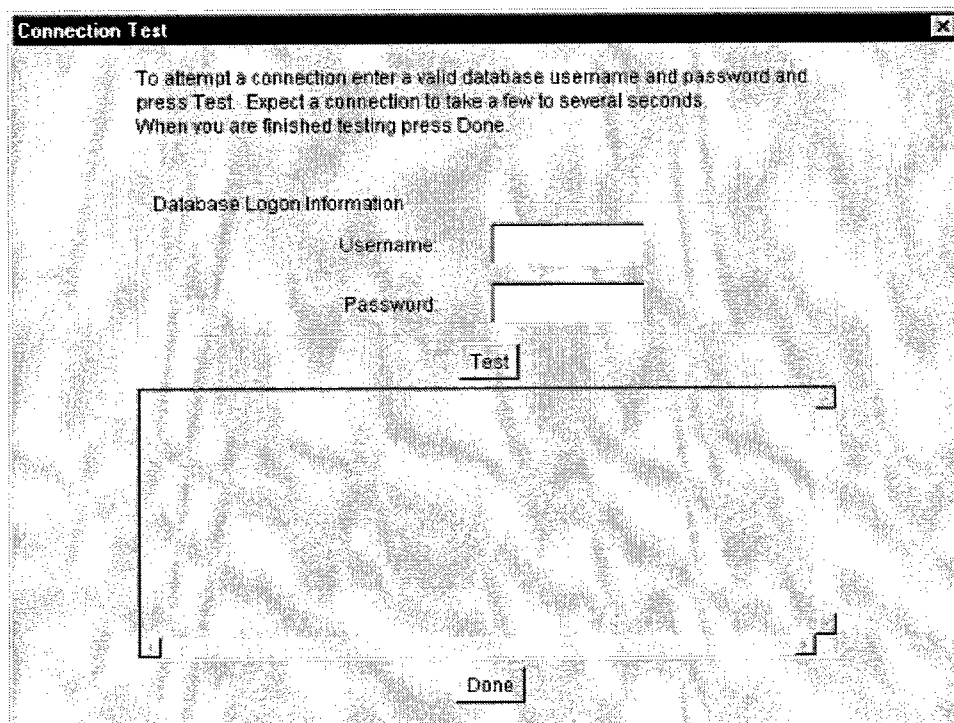**Oracle Net8 Easy Config**

Press Test Service if you would like to test that a connection to the database can be made using the information you provided.

When you are ready press Finish to create the new Service Name.

Test Service

Cancel   < Previous   Next >   Finish

Click the *Test Service* button to test your connection to the Oracle server.

Connection Test

To attempt a connection enter a valid database username and password and press Test. Expect a connection to take a few to several seconds. When you are finished testing press Done.

Database Logon Information

Username:

Password:

Test

Done

Enter an appropriate *Username* and *Password* for the database you are connecting to and click the *Test* button. You should get the following result:

Connection Test

To attempt a connection enter a valid database username and password and press Test. Expect a connection to take a few to several seconds. When you are finished testing press Done.

Database Logon Information

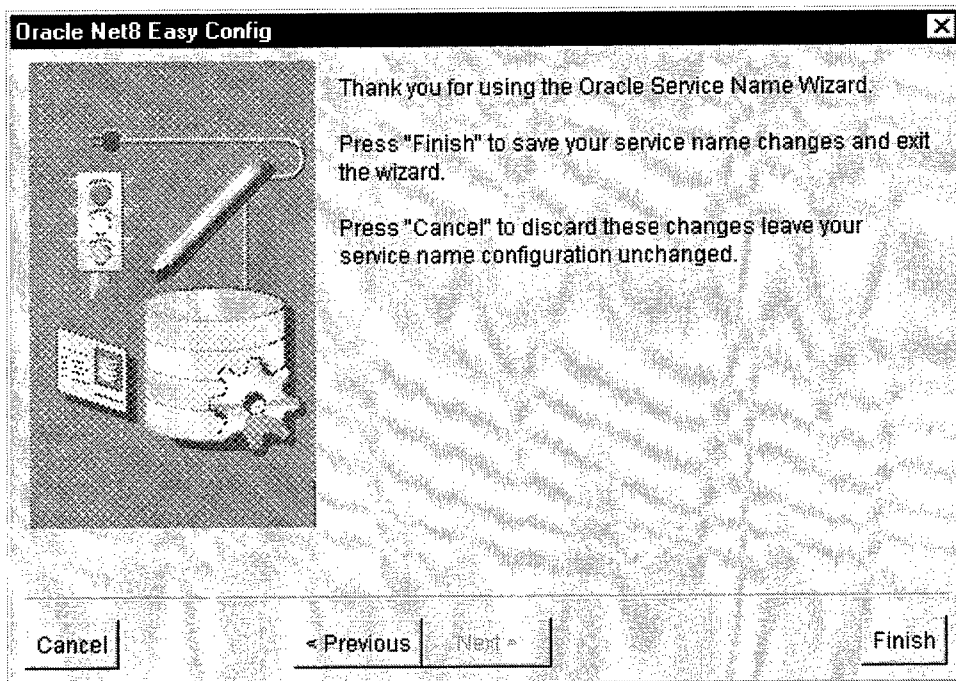Username:

Password:

Test

Connecting...

The connection test was successful.
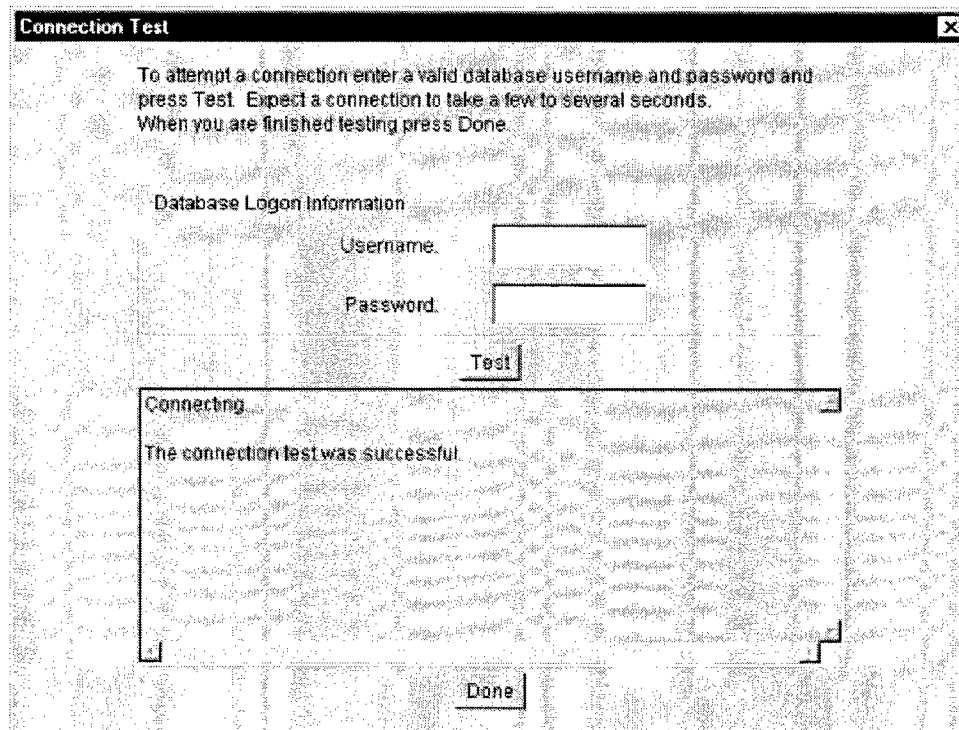
Done

If so, click the *Done* button.

Oracle Net8 Easy Config

Press Test Service if you would like to test that a connection to the database can be made using the information you provided.

When you are ready press Finish to create the new Service Name.

Test Service

Cancel   < Previous   Next >   Finish

Now click the *Next* button.

```
Oracle Net8 Easy Config                                    ☒

        Thank you for using the Oracle Service Name Wizard.

        Press "Finish" to save your service name changes and exit
        the wizard.

        Press "Cancel" to discard these changes leave your
        service name configuration unchanged.



  Cancel            < Previous   Next >              Finish
```
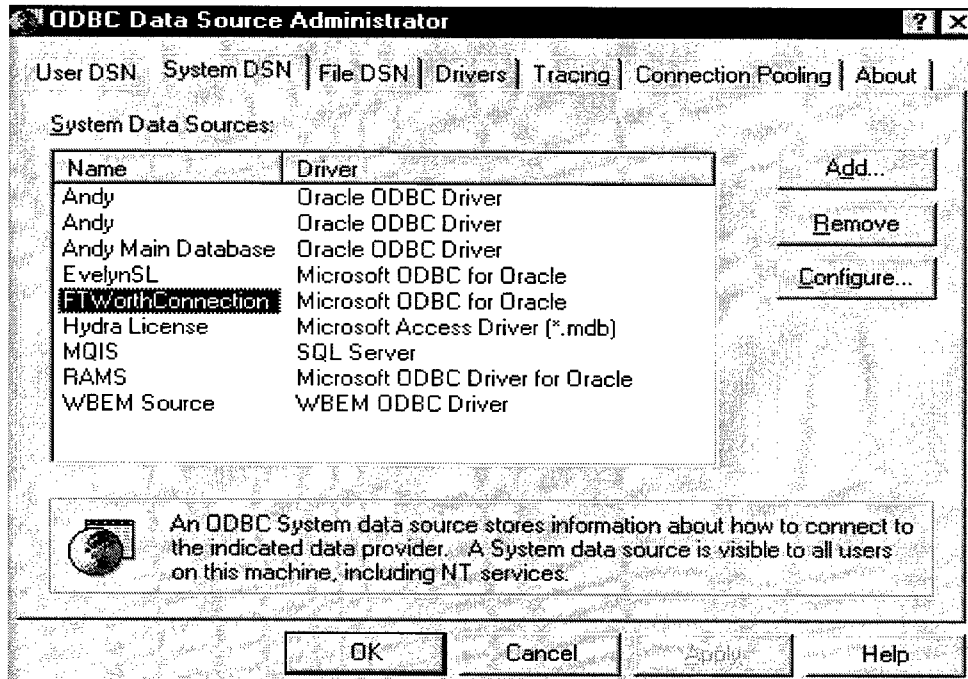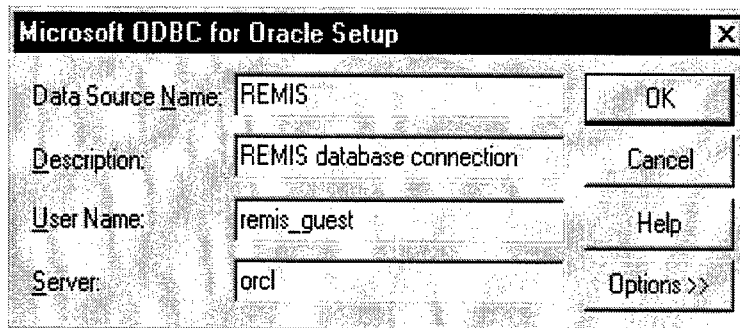
Now you are ready to enter the Windows Control Panel and set up your ODBC connection environment using the service you just created.

Step 2: Create an Open Database Connection (ODBC) Data Source to the REMIS Oracle Database

1. From the *Start* menu, select *Settings* and *Control Panel.*

2. Double-click the *ODBC Data Sources* icon.

3. Select the *System DSN* tab.

ODBC Data Source Administrator

User DSN | System DSN | File DSN | Drivers | Tracing | Connection Pooling | About |

System Data Sources:

Name	Driver
Andy	Oracle ODBC Driver
Andy	Oracle ODBC Driver
Andy Main Database	Oracle ODBC Driver
EvelynSL	Microsoft ODBC for Oracle
FTWorthConnection	Microsoft ODBC for Oracle
Hydra License	Microsoft Access Driver (*.mdb)
MQIS	SQL Server
RAMS	Microsoft ODBC Driver for Oracle
WBEM Source	WBEM ODBC Driver

Add...
Remove
Configure...

An ODBC System data source stores information about how to connect to the indicated data provider. A System data source is visible to all users on this machine, including NT services.

OK | Cancel | Apply | Help

4. Press the *Add* button.

5. Select the *Microsoft ODBC for Oracle* driver and press *Finish*.

6. Enter the desired connection name in the text box beside *Data Source Name*. Press the Tab key to move to the next entry box. Enter the description of the connection, the user name, and the server where the Oracle tables reside. Select *OK* when finished.


Microsoft ODBC for Oracle Setup

Data Source Name:	REMIS	OK
Description:	REMIS database connection	Cancel
User Name:	remis_guest	Help
Server:	orcl	Options >>

7. Press *OK* to exit the ODBC Administrator.

Step 3: Add the Cadastre Real Estate GIS Tool to the Toolbar

This step can be implemented in ArcCatalog or ArcMap. Follow the steps listed below for the preferred option. If ArcMap is used, you will have the option to save the tool either for a specific file or globally (in the normal.mxt template), meaning that every file loaded or every new file created will have the tool accessible. If ArcCatalog is used, the tool will be saved automatically in the normal.gxt file.

Using ArcCatalog

1. Start ArcCatalog.

2. Select *Tools* menu.

3. Go to *Customize, Commands*, and *Add from file*.

4. Select the library file *REMISGeoDB.dll*.
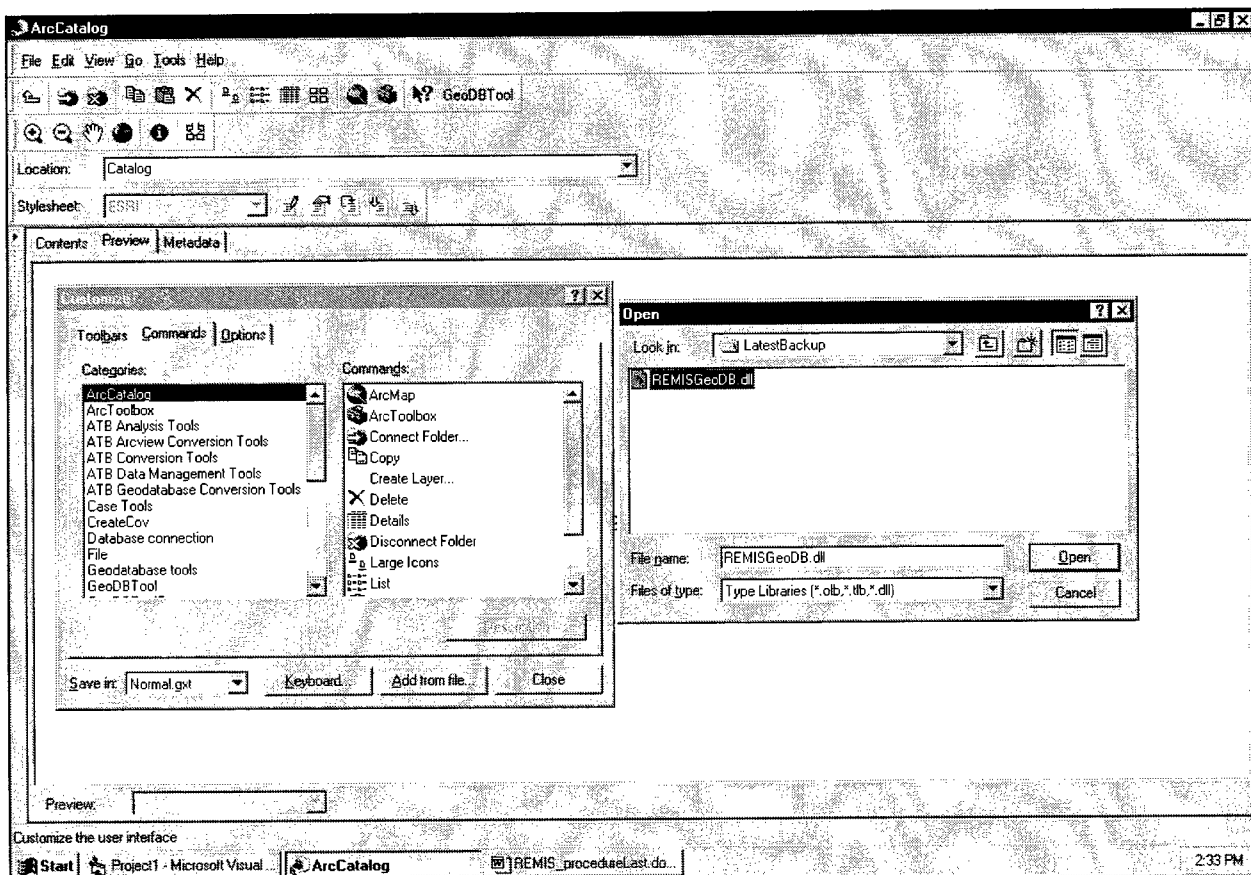
5. An Added Objects box will appear with the *REGeoClass* listed. Press the *OK* button.

6. In the *Commands* tab, choose *GeoDBToolCategory* from the Categories list.

7. Drag the *GeoDBTool* from the Commands window to the toolbar.

8. Close the Customize window.

Using ArcMap

1. Start ArcMap.

2. Select *Tools* menu.

3. Go to *Customize, Commands*, and *Add from file*.

4. At the bottom of the screen, indicate if you want to add the tool to the current opened file or to the general template (normal.mxt).

5. Select the library file *REMISGeoDB.dll*.
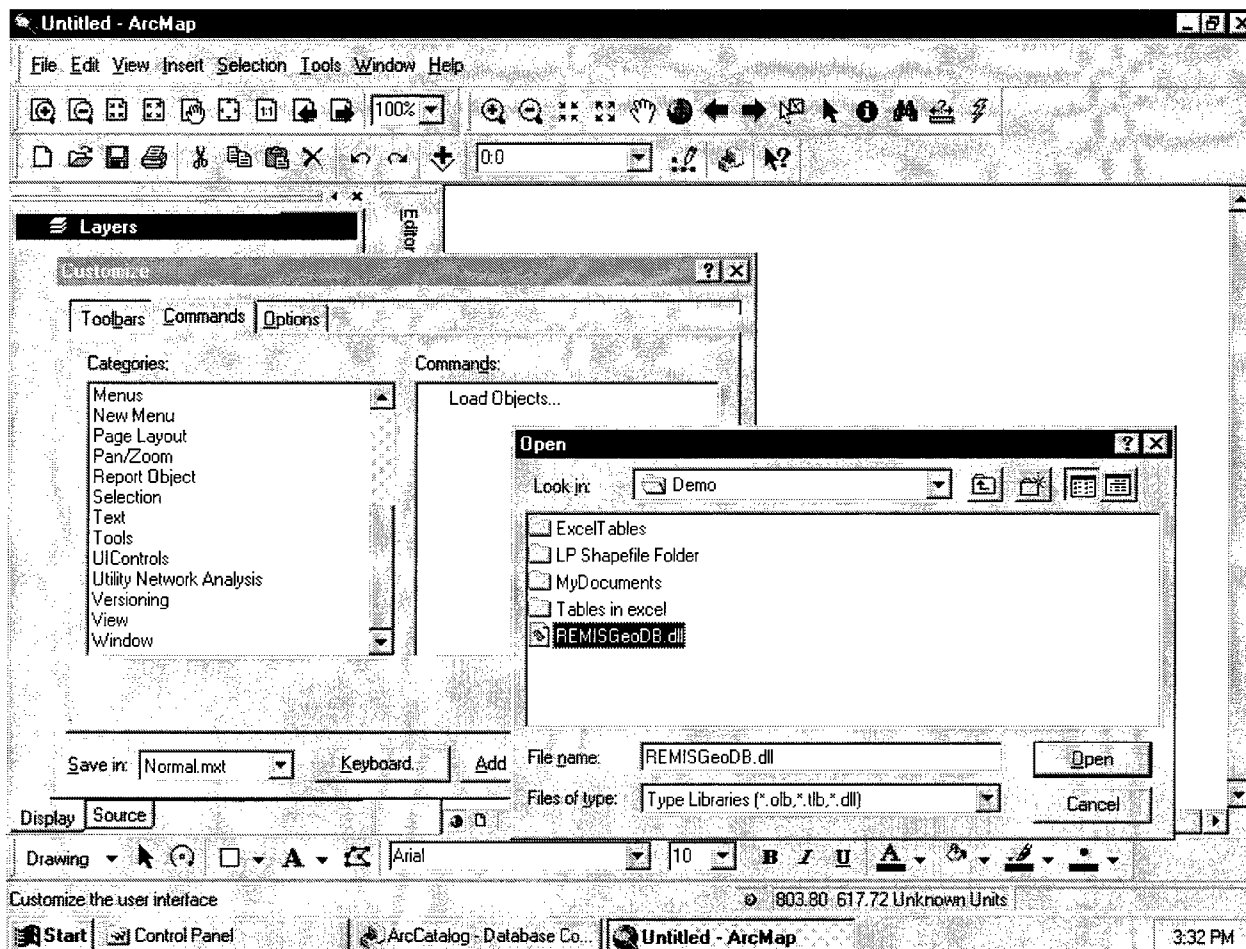
6. An Added Objects box will appear with the *REGeoClass* listed. Press the *OK* button.

7. In the *Commands* tab, choose *GeoDBToolCategory* from the Categories list.

8. Drag the *GeoDBTool* from the Commands window to the toolbar.

9. Close the Customize window.

Step 4: Initialize a Personal Geodatabase

1. Start ArcCatalog.

2. Create a new folder for the REMIS project.

   (a) Right click in the *Catalog* option.

   (b) Select the option *Connect Folder....*

   (c) Select the drive where the folder will be created.

(d) Right click on the drive folder just created and right click on it to create a new folder.

3. Right click on the new folder and click on *New* and *Personal Geodatabase* to create a personal geodatabase.
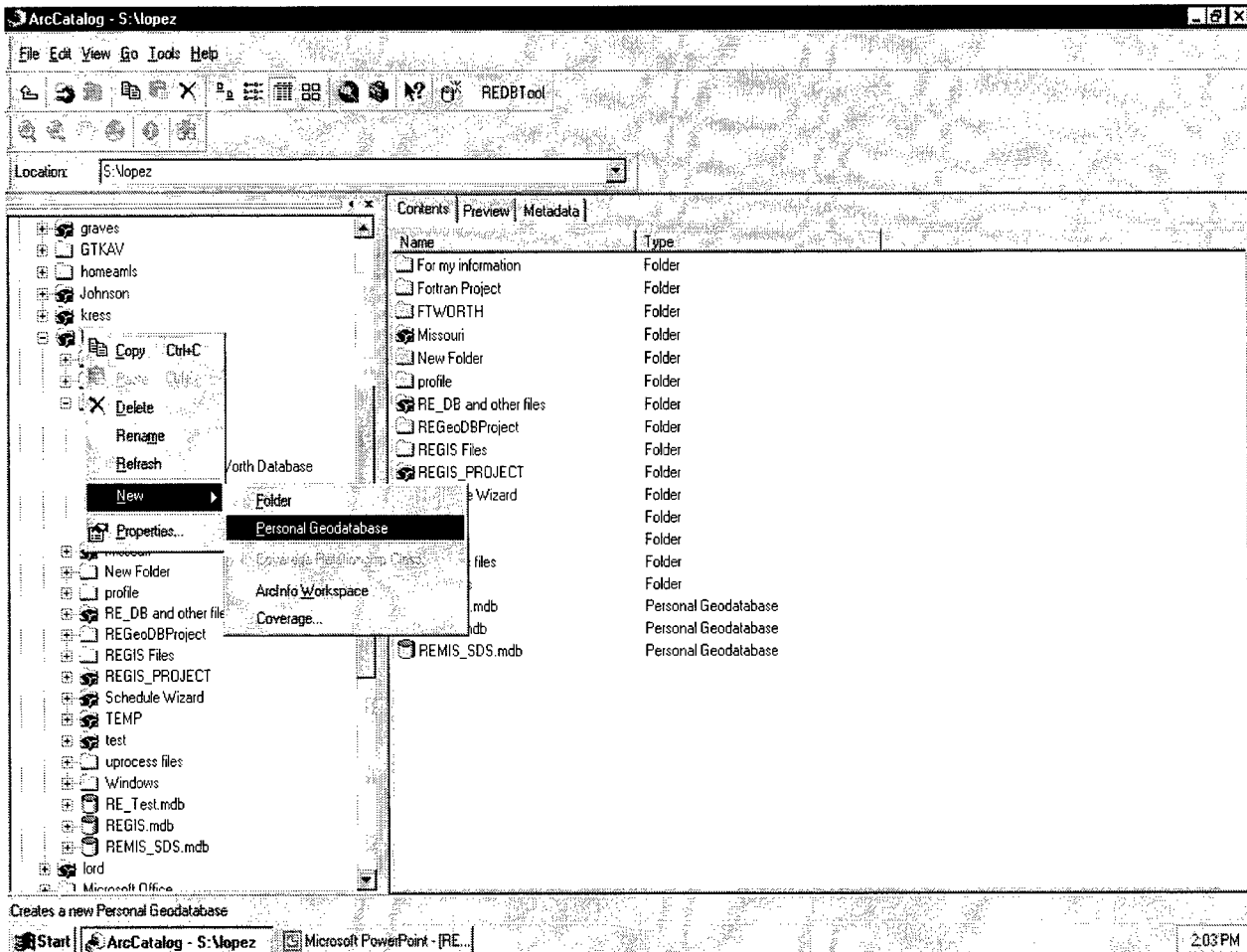

4. Type in the name of the personal geodatabase. The file extension *.mdb* will be added automatically.

Step 5: Creating Cadastre Tables, Domains, and Relationships

1. Open ArcCatalog or ArcMap.

2. Click on the command *Create Cadastre Tables, domains, and relationships.* This creates the Cadastre Feature Dataset that contain the five cadastre tables: cdrelacq, cdrelout, cdrelbnd, cdrelenc, and cdreldsp. The tables are created in

MS Access 2000 and can be seen from ArcCatalog. In ArcMap, to view the feature datasets and their contents, click the feature datasets from the ArcCatalog geodatabase and drag them (one by one) into ArcMap. You will not be able to click and drag the whole personal geodatabase at once into ArcMap, only the feature datasets (one by one) and other tables (one by one) that exist in the personal geodatabase.
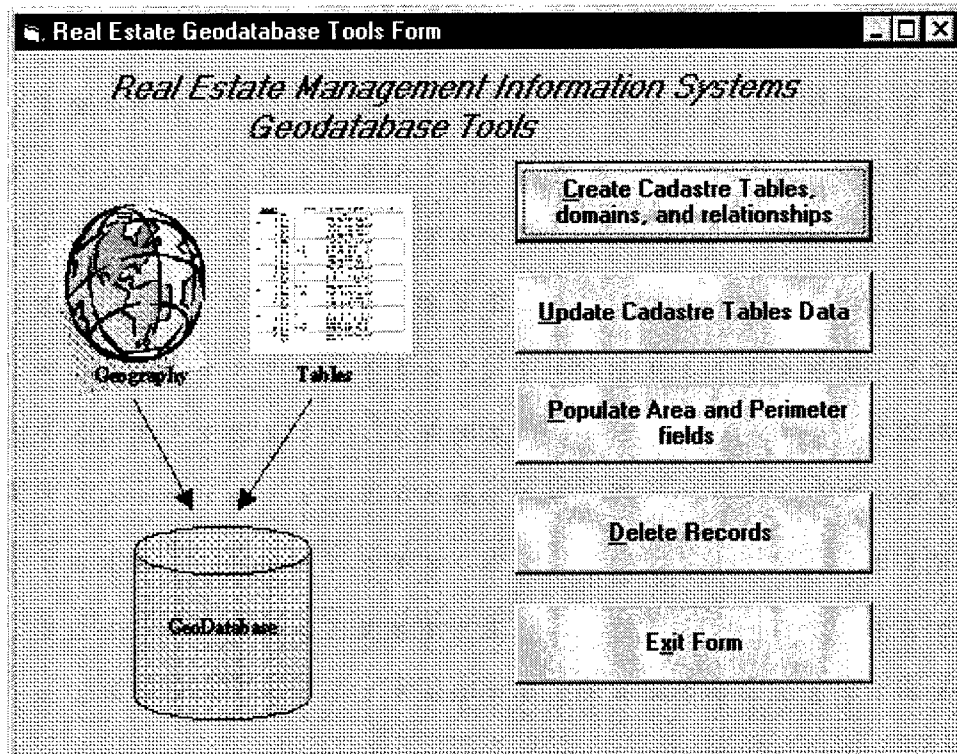
3. After you click on the *Create Cadastre Tables, domains, and relationships* command, another form appears. It allows you to enter the location of the personal geodatabase.
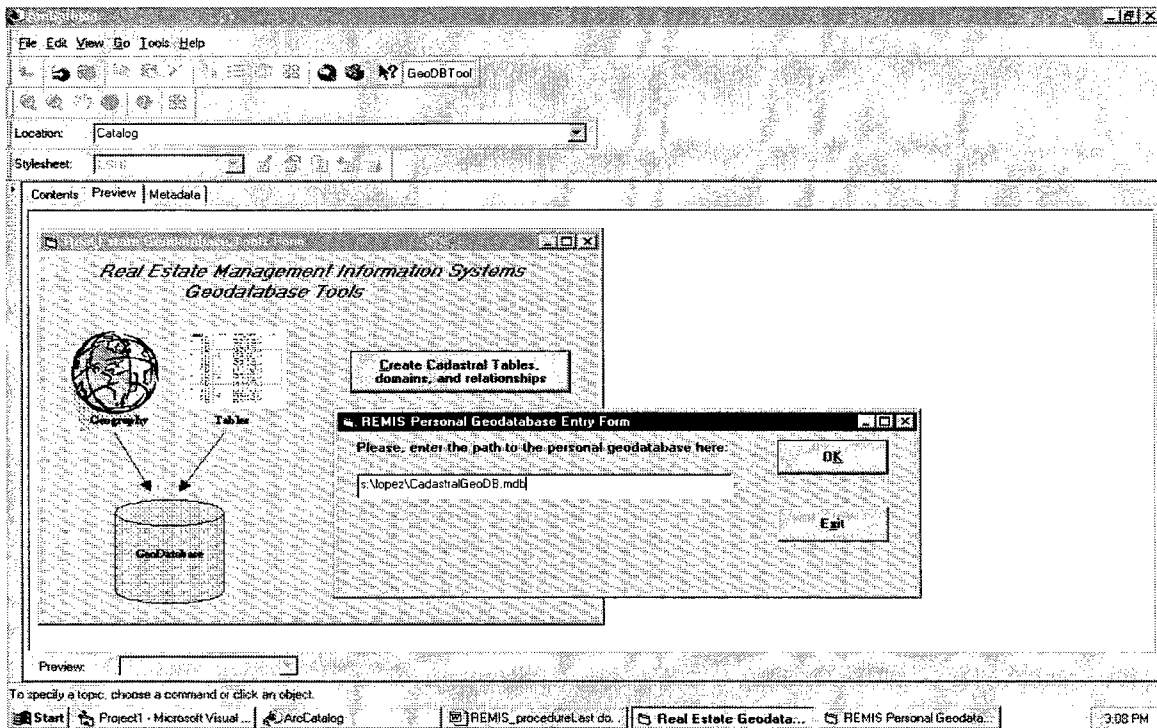
4. Once you press the *OK* button, a List Box appears letting you know what the command is doing.

Appendix B   Instructions for Using the Cadastre Real Estate GIS Software Tool
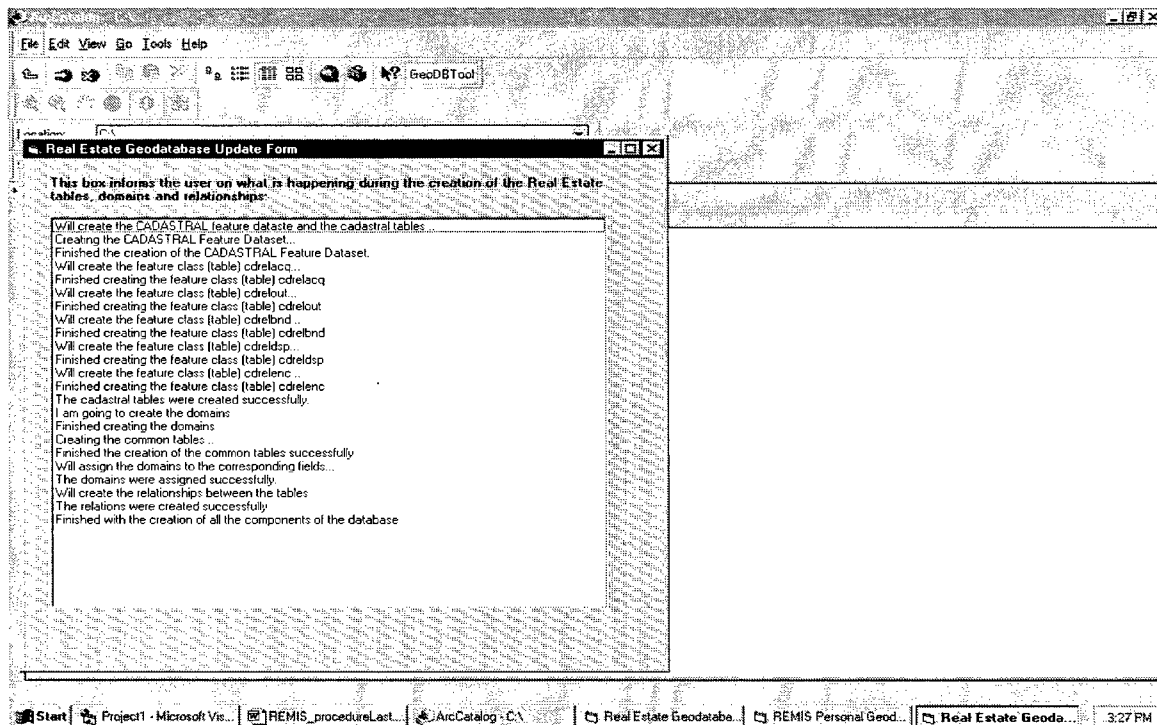
5. After the command is finished, close the forms (except the form with all the command buttons, the Geodatabase Tools Form) and compact the database by right-clicking the geodatabase and choosing the *Compact Database* option.

   Note: The Geodatabase Tools Form will be minimized if you click on any other part of ArcCatalog or ArcMap. If this happens, just maximize the form if you need to perform other commands from it.

6. Refresh the database by clicking on the geodatabase and then pressing the *F5* key in ArcCatalog.

Step 6: Populate the Cadastre Geodatabase with GIS Geospatial Data

A. X and Y Domains

The spatial domain is best described as the allowable coordinate range for x,y coordinates, m (measure) values, and z values. The precision describes the number of system units per one unit of measure. A spatial reference with a precision of 1 will store integer values, while a precision of 1,000 will store three decimal places. Once the spatial reference for a feature dataset or stand-alone feature class has been set, only the coordinate system can be modified; the spatial domain is fixed.

If adding a new coordinate outside a geodatabase x,y domain in ArcMap returns the error:

> **"The Create Feature task could not be completed.
> The coordinates or measures are out of bound."**

the cause is that coordinates of the added feature are beyond the extents of the feature class x,y domain. Geodatabase feature coordinates *must* fall within the feature class x,y domain extent. The x,y domain is set when the data set or stand-alone feature class is created. It cannot be updated after creation.

Solution

1. Right-click the problem feature class from ArcCatalog and click *Export* and *Geodatabase to Geodatabase*.

2. Navigate to the output Geodatabase location and type the name of the new feature class.
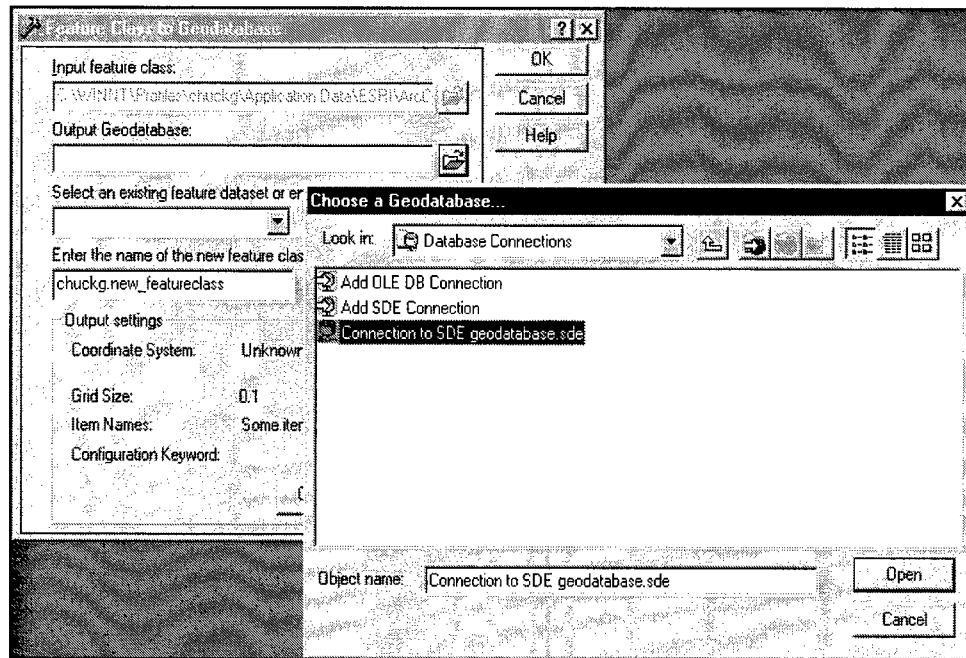
3. Click *Change Settings*, the *Spatial Ref* tab and *Change*.
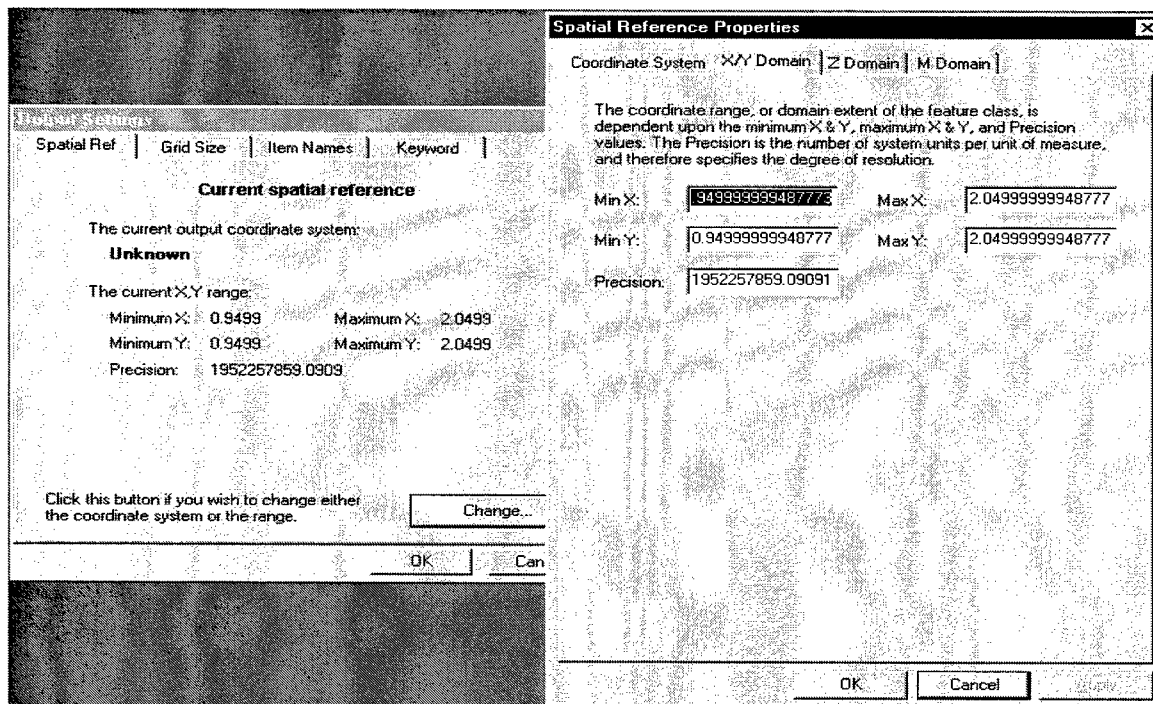
4. Click the *X/Y Domain* tab and update the extents to accommodate the new data you wish to add.

5. Click *OK* on the three dialog boxes to initiate the export.

Appendix B Instructions for Using the Cadastre Real Estate GIS Software Tool

6. If using an SDE Geodatabase, right-click the new feature class to register it as versioned before returning to ArcMap to edit.

7. Verify the new feature class extents in ArcMap by right-clicking on *Feature Class*, *Choose Properties*, and the *Source* tab.

All feature classes in a feature data set possess the X/Y domain of the feature data set. If your original feature class is in a feature data set, the new feature class cannot reside in the original feature data set. It must be created as a stand-alone feature class or a feature class in a feature data set with extents that go far enough to encompass the new coordinates.

B. Coordinate Systems

There are two types of coordinate systems: geographic and projected. Geographic coordinate systems use latitude and longitude coordinates on a spherical model of the earth's surface. Projected coordinate systems use a mathematical conversion to transform latitude and longitude coordinates that fall on the earth's three-dimensional surface to a two-dimensional surface.

To choose a coordinate system in ArcCatalog:

1. Start ArcCatalog.

2. Choose the coordinate system by doing the following steps:

   (a) Right-click on the feature data set.

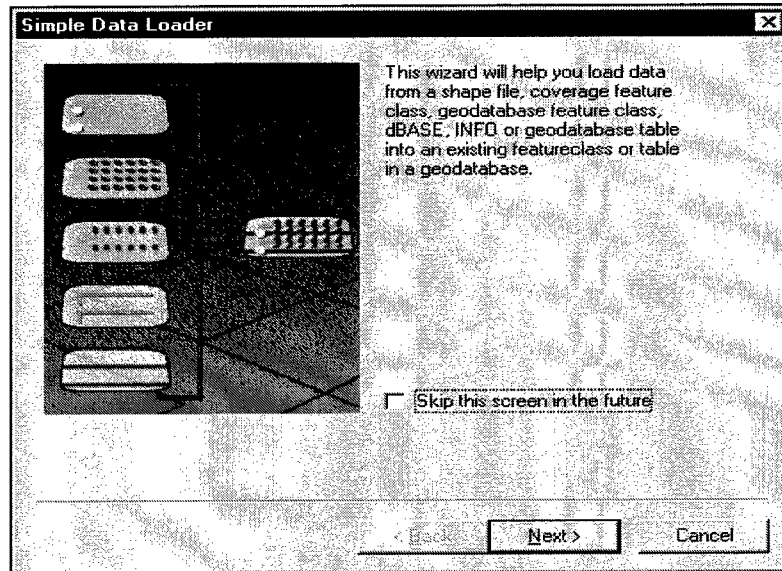   (b) Select the option *Properties*.

   (c) Click *Edit*.
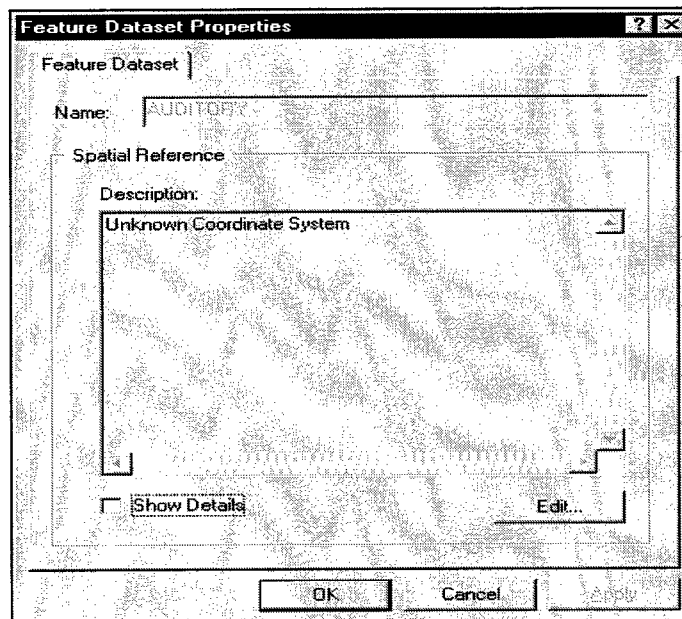
(d) Click the *Select* button to select a predefined coordinate system or select the *New* button to create a new coordinate system. Navigate to the spatial reference you want to use. Click the *Add* button.
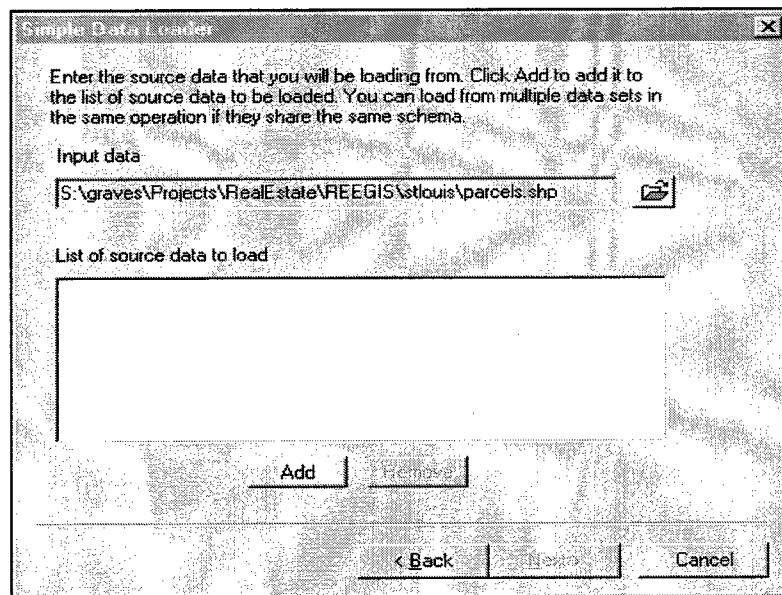
(e) After the addition is done, click the *Apply* button.
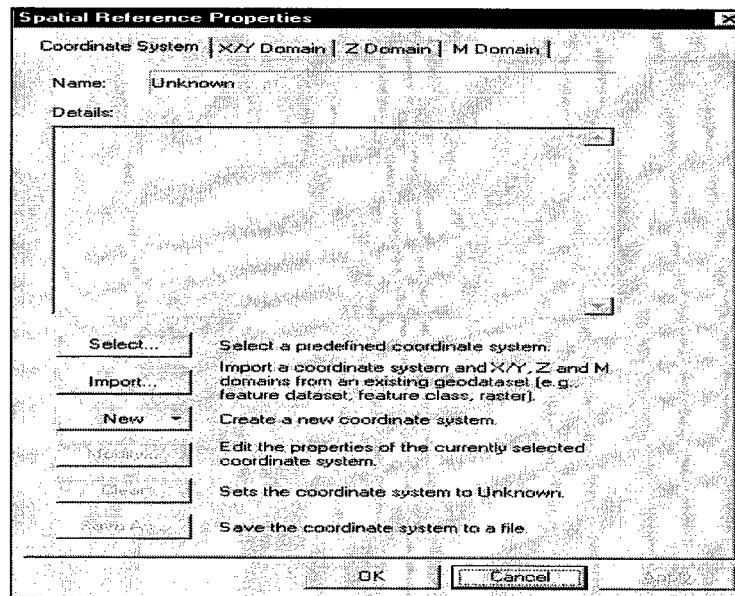
(f) To see the details of your new dataset's spatial reference, check *Show Details*.

(g) Click *Apply* again and the *OK* button.

(h) Refresh the geodatabase by clicking on the geodatabase and press the *F5* key.

C. Migrating a shapefile and/or coverage to an SDS personal geodatabase

1. In the ArcCatalog tree, right-click the table or feature class that you want to load data into and click *Load Data*.

2. Click *Next* on the introductory panel.

Simple Data Loader

This wizard will help you load data from a shape file, coverage feature class, geodatabase feature class, dBASE, INFO or geodatabase table into an existing featureclass or table in a geodatabase.

☐ Skip this screen in the future

[< Back] [Next >] [Cancel]

3. Browse to the input feature class or table.

Simple Data Loader

Enter the source data that you will be loading from. Click Add to add it to the list of source data to be loaded. You can load from multiple data sets in the same operation if they share the same schema.

Input data

S:\graves\Projects\RealEstate\REEGIS\stlouis\parcels.shp

List of source data to load

[Add] [Remove]

[< Back] [Next >] [Cancel]

4. Click *Add* to add it to the list of source data.

5. Repeat steps 3 and 4 until you have specified all of the source data.

6. Click *Next*.

7. If you don't want to load data into a specific subtype of the target, click the first option, and then skip to step 10 (*ArcInfo and ArcEditor only*).

Simple Data Loader

Select the target geodatabase and feature class that you will be loading the
source data into.

Choose an existing geodatabase:

S:\lopez\NG_Geodatabase\WLAND_CORE.mdb

Select the target feature class:

Noise_Abatement_Area

(•) I do not want to load all features into a subtype

( ) I want to load all features into a subtype

Select the target subtype:

< Back   Next >   Cancel

8. If you want to load data into a specific subtype, click the second option
    (*ArcInfo and ArcEditor only*).

9. Click the dropdown arrow and click the subtype you want to load the source
    data into.

10. Click *Next*.

11. To match a source field with a field in the target feature class or table, click
    the dropdown arrow in the Matching Source Field list and click the field from
    the source data that you want to match to the target field.

Simple Data Loader

For each target field, select the source field that should be loaded into it.

Target Field	Matching Source Field
TRACT_NO_ [string]	TRACT_NO_ [string]
OWNER [string]	OWNER [string]
FEE [string]	FEE [string]
PERMIT [string]	PERMIT [string]
PERM__FLOW [string]	PERM__FLOW [string]
EASE [string]	EASE [string]
REMARKS [string]	REMARKS [string]
SURVEY [string]	SURVEY [string]
REMARKS2 [string]	REMARKS2 [string]

Reset

< Back   Next >   Cancel

12. Repeat step 11 until you have matched all the fields you want to load from
    your source data to the target fields.

13. If you don't want data from a field in the source data to be loaded into the target data, leave the Matching Source Field blank.

14. Click *Next*.

15. If you want to load all of the source data, click the first option and then skip to step 20.
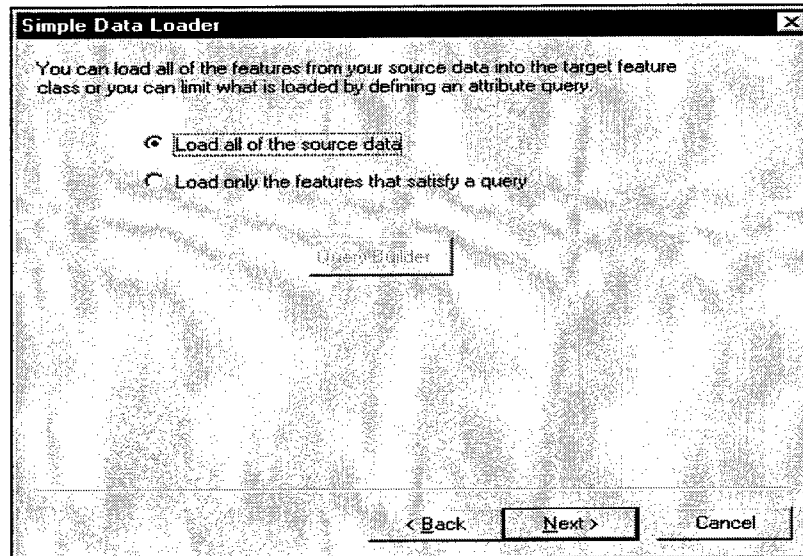
16. If you want to use an attribute query to limit the features from the source data loaded into the target, click the second option.

17. Click *Query Builder* to open the Query Builder dialog box.

18. Use the Query Builder to create a query to limit the features or rows from the source data that are going to be loaded into the target.
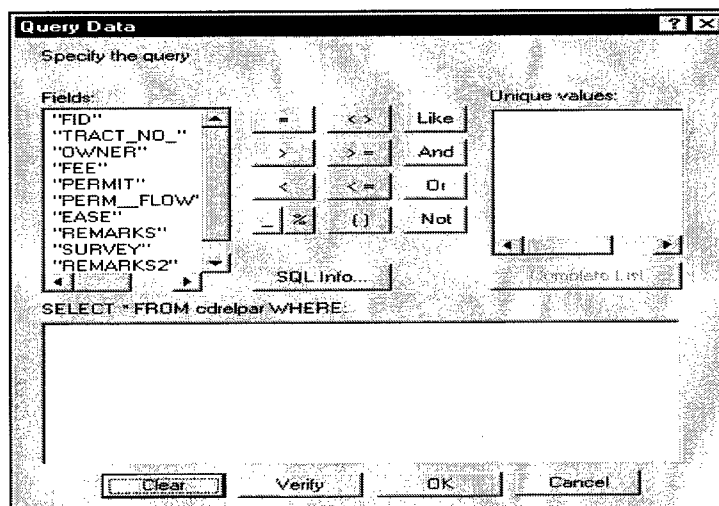
19. Click *OK*.

20. Click *Next*.

21. Review the options you have specified for loading your data. If you want to change something, you can go back through the wizard by clicking *Back*.
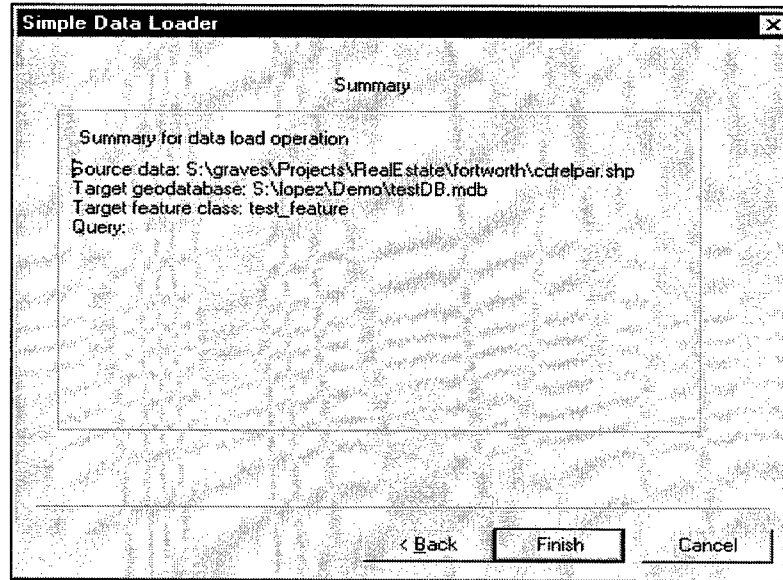
22. When satisfied with your options, click *Finish* to load your data.

Notes: If you choose to load data into a specific subtype, you won't be able to match a field from the source data to the subtype field in the target data; the subtype field will be automatically populated.

When matching fields, you can browse the source data's field values to help you correctly match the source and target fields.

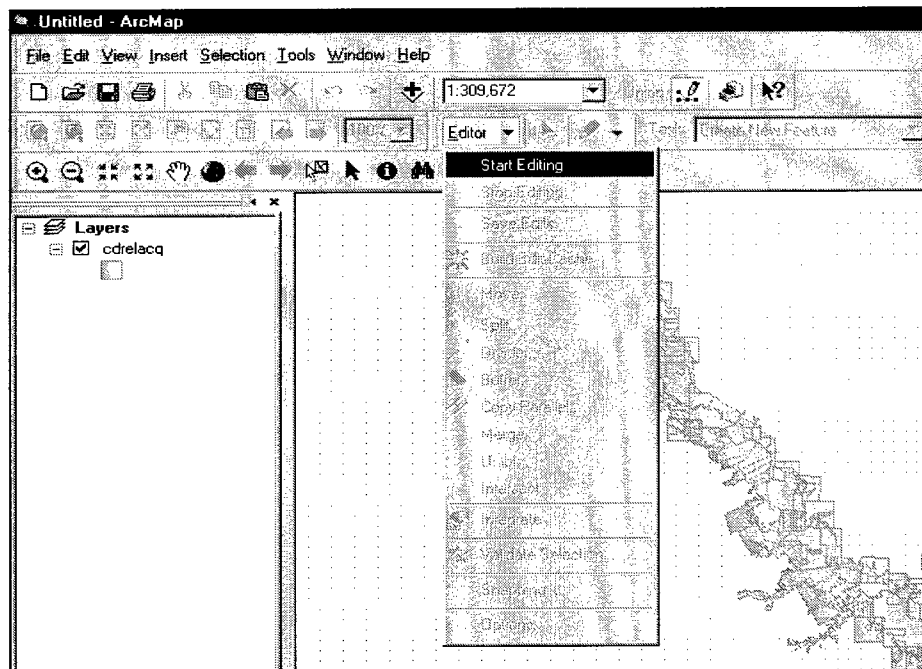23. The following fields in each Cadastre table need to be populated for each polygon:

Cadastre Table	**Fields**
Cdrelacq	**PROJ_ID** and **TRACT_NO**
Cdrelbnd	**PROJ_ID**
Cdreldsp	**PROJ_ID** and **DISP_UNIT**
Cdrelenc	**PROJ_ID**, **W_CODE**, and **ENC_ITEM**
Cdrelout	**PROJ_ID**, **CONTRACT_NO**, **MOD_NUMBER**, and **OUTGRANT_STATUS**

24. If some of these fields are not populated, you will need to update them manually using ArcMap. To access ArcMap from ArcCatalog, click on the icon in the tool bar that looks like the following:

To populate the fields in ArcMap:

    a. In ArcCatalog, click on the feature class (tables with polygons) and drag it to the ArcMap grid window. Repeat this step for each one of the feature classes.
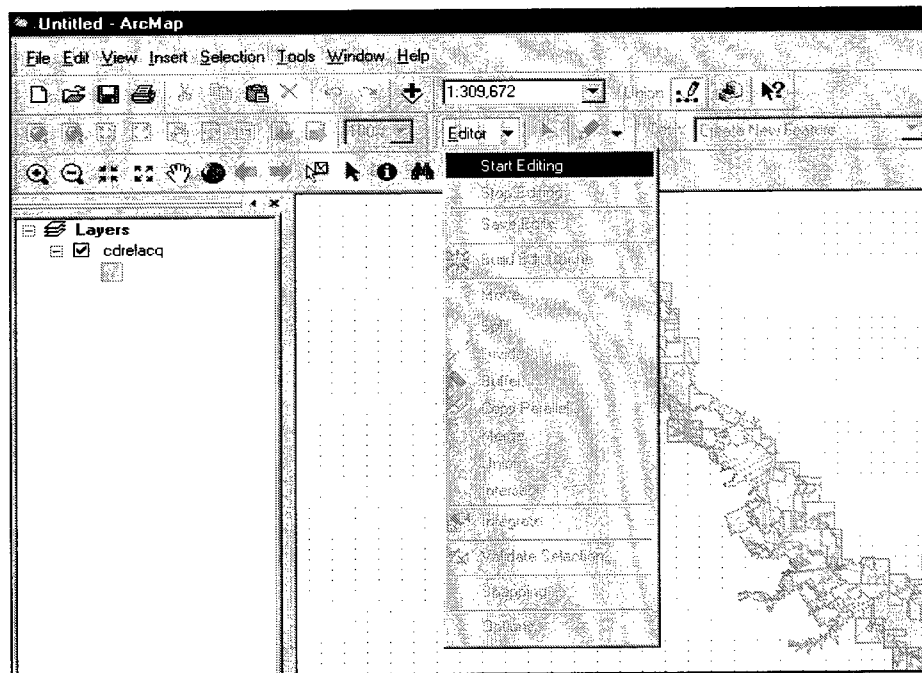
    b. Use the Editor Tool.

    c. Click on *Start Editing*.

    d. Start typing the values for the necessary fields.

    e. After editing the fields, choose *Save Edits* and then *Stop Editing* in the Editor Tool. You do not have to save the file in ArcMap as long as Save Edits was selected before going back to ArcCatalog.

    f. When finished, exit ArcMap and return to ArcCatalog.

    g. In ArcCatalog, refresh the database to see the changes done in ArcMap.

To populate the fields in ArcMap:

    a.   In ArcCatalog, click on the feature class (tables with polygons) and drag it to the ArcMap grid window. Repeat this step for each one of the feature classes.
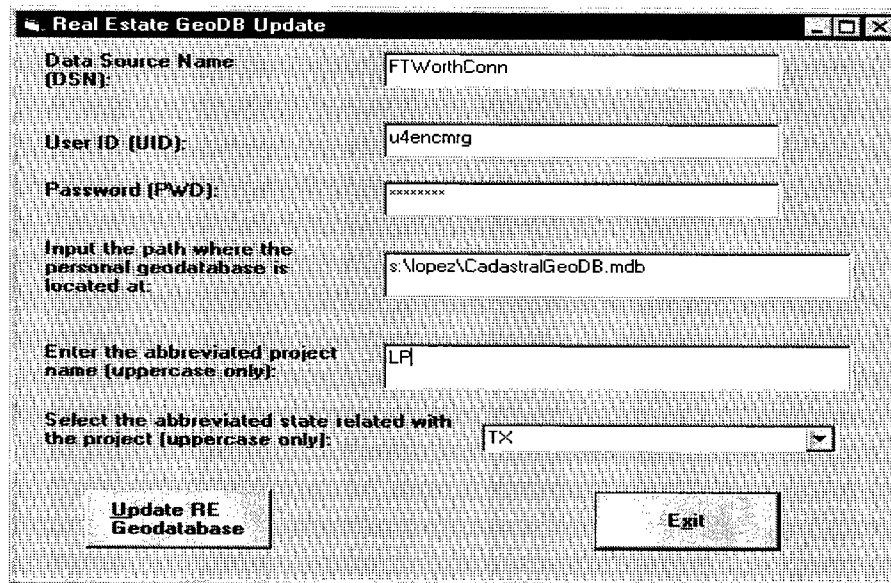
    b.   Use the Editor Tool.

    c.   Click on *Start Editing.*

    d.   Start typing the values for the necessary fields.

    e.   After editing the fields, choose *Save Edits* and then *Stop Editing* in the Editor Tool. You do not have to save the file in ArcMap as long as Save Edits was selected before going back to ArcCatalog.

    f.   When finished, exit ArcMap and return to ArcCatalog.

    g.   In ArcCatalog, refresh the database to see the changes done in ArcMap.

Step 7: Update Cadastre Tables Data

The command *Update Cadastre Tables Data* imports the REMIS Oracle Database data to the corresponding fields in the Cadastre tables.

1. The following form appears. You will need to coordinate with the REMIS database administrator at the District to obtain the necessary access information, and the ODBC connection must have been properly configured (as described earlier in this document).
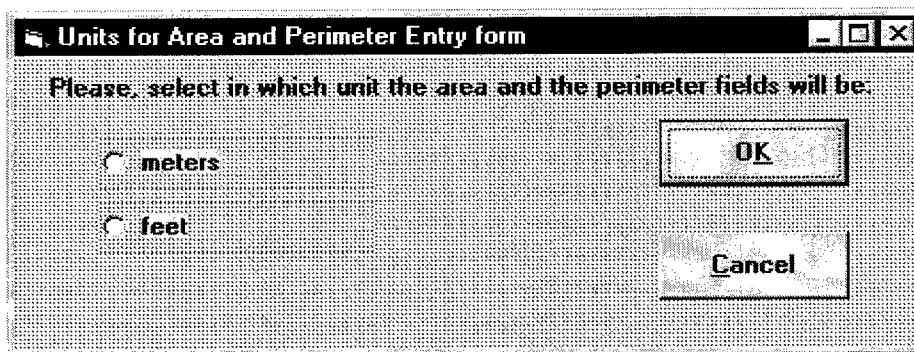

2. Select the *Update RE Geodatabase* button after the information is entered to start the update of the Cadastre tables.

3. A window will appear informing you which tables are being updated.

4. Refresh the database by clicking on the geodatabase and then pressing the *F5* key.

Step 8: Populate Area and Perimeter Fields

The command *Populate Area and Perimeter fields* populates the area and perimeter fields of the polygons with feet/square-feet or meters/square-meters units.

1. Select the desired unit of measure for the area and perimeter fields.

2. Press *OK*. When the updating of the fields with the unit is done, a label will appear notifying you that the update is finished.

Units for Area and Perimeter Entry form

Please, select in which unit the area and the perimeter fields will be.
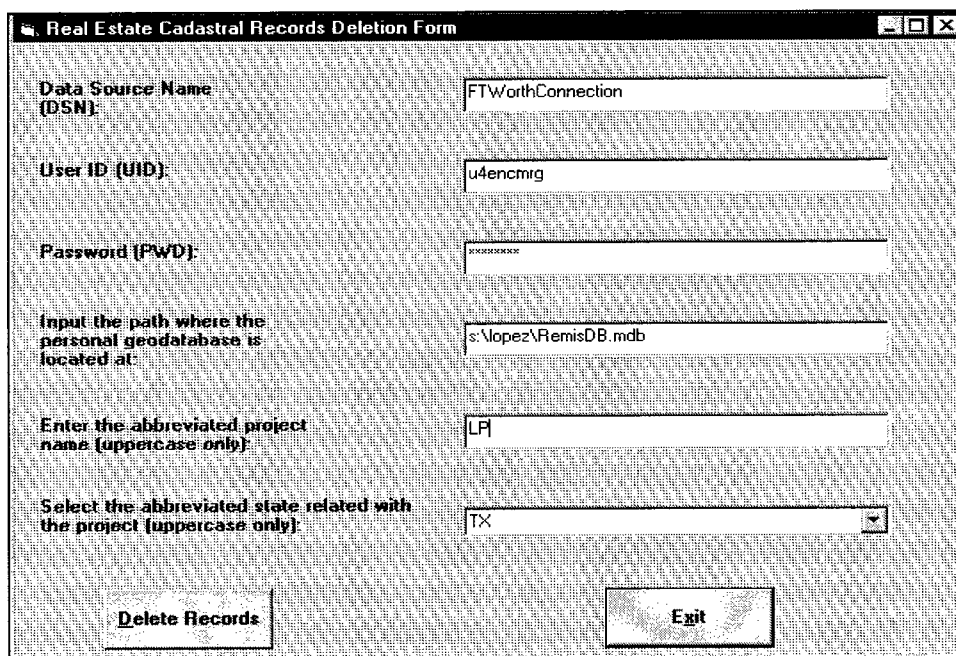
○ meters

○ feet

OK

Cancel

Step 9: Delete Records

The command *Delete Records* will delete those records from the Cadastre tables that no longer exist in the REMIS Oracle Database. It will delete the records and the polygons related to those records.

1. A form appears with fields that you will need to complete with information to allow the connection to the REMIS Oracle Database and with the project id and which state the project is located in.

Real Estate Cadastral Records Deletion Form

Data Source Name (DSN):	FTWorthConnection
User ID (UID):	u4encmrg
Password (PWD):	xxxxxxx
Input the path where the personal geodatabase is located at:	s:\lopez\RemisDB.mdb
Enter the abbreviated project name (uppercase only):	LR
Select the abbreviated state related with the project (uppercase only):	TX

Delete Records   Exit

2. Select the *Delete Records* button after the information is entered to start the deletion of the records that no longer exist in the REMIS Oracle Database.

3. A List Box form appears, informing the user about the deletion routine.

4. Refresh the database by clicking on the geodatabase and then pressing the *F5* key.

Step 10: Exit the Cadastral Real Estate Geodatabase Tool

1. Close all forms when you are ready to exit the geodatabase.

2. The command *Exit Form* in the form will close the Geodatabase Tools form and the program.

Final Notes about the Tool

After the GeoDBTool button is clicked once, it becomes disabled. To enable the button again, do the following:

1. Click on the *Tools* menu.

2. Select *Customize*. The GeoDBTool becomes enabled again.

3. Close the Customize Window.

4. If you want to take the button out of the tool bar, click on it and drag it anywhere in the screen. This will make the button disappear.

Another way to enabled it is by exiting ArcCatalog (or ArcMap) and then open the applications again.

REPORT DOCUMENTATION PAGE		Form Approved OMB No. 0704-0188

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13. SUPPLEMENTARY NOTES

14. ABSTRACT

This report summarizes the research results to develop and demonstrate a geographic information system (GIS) assisted approach to meet the spatial data management and analysis demands of the Corps real estate activities. The report includes an overview of the cadastre Real Estate GIS database design that is compliant with the CADD/GIS Technology Center Spatial Data Standards and the cadastre Real Estate GIS software tool that implements the SDS-compliant cadastre real estate GIS database design in the object-oriented ArcInfo 8 software and that populates the database by linking to the non-spatial Real Estate Management Information System (REMIS). A test implementation of a cadastre Real Estate GIS at Lake of the Pines, Texas, is also presented.

15. SUBJECT TERMS	Geodatabase	Real Estate Management Information System	Spatial Data Standards
Cadastral	Geographic information system	Real estate	
Cadastre	GIS	REMIS	

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